PB89-128383

Superfund Record of Decision (EPA Region 8)
Central City/Clear Creek, Colorado
March 1988. Second Remedial Action

(U.S.) Environmental Protection Agency
Washington, DC

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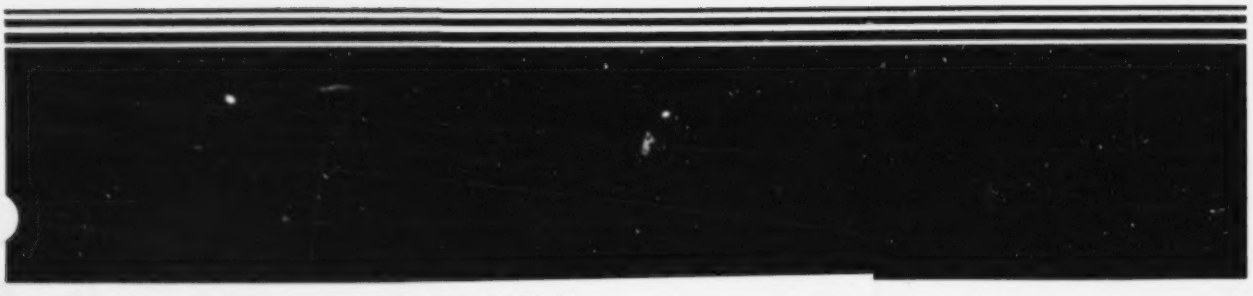
Superfund Record of Decision:

Central City / Clear Creek, CO



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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Clear Creek/Central City site is located approximately 30 miles west of Denver in Clear Creek and Gilpin Counties, CO. The site consists primarily of acid mine drainages from five mines/tunnels and adjacent milling and mining wastes. Currently, acid mine drainage and runon and runoff from the tailings and waste rock piles have affected downstream surface water quality. In addition to the direct discharge from the mine tunnels, contaminated water may enter Clear Creek and North Clear Creek during overland sheet flow. This occurs during rapid snowmelt and storms. The resulting surface flow across the tailings and waste rock piles dissolves soluble minerals and transports particulate tailings and waste rock materials into the creeks. All this results in elevated creek acidity and metal loads. The introduction of tailings and waste rock into the creeks could also occur due to catastrophic collapse of tailings and waste rock piles during a flash flood or as a result of undercutting of the base of the pile under any flow regimen. The discharges from the five tunnels were addressed in the first remedial action operable unit for this site. The primary contaminants of concern for human receptors in surface water include: aluminum, arsenic, cadmium, chromium (IV), lead, manganese, nickel, and silver. For aquatic receptors, the above list expands to include: copper, fluoride, and zinc.
(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision
Clear Creek/Central City, CO
Second Remedial Action
Contaminated Media: sw
Key Contaminants: inorganics (metals)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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EPA/ROD/R08-88/019
Clear Creek/Central City, CO
Second Remedial Action

16. ABSTRACT (continued)

The selected remedial action for this site includes: slope stabilization at the Big Five Tunnel and Gregory Incline; monitoring of the gabion wall at the Gregory Incline; and run-on control at the Argo Tunnel, Big Five Tunnel, Gregory Incline, National Tunnel, and the Quartz Hill Tunnel. The estimated present worth cost for this remedial action is $1,049,600.

DECLARATION
FOR THE
RECORD OF DECISION

SITE NAME AND LOCATION

Clear Creek/Central City Superfund Site
Clear Creek and Gilpin Counties, Colorado
Operable Unit No. Two
Tailings and Waste Rock Remediation

STATEMENT OF PURPOSE

This decision document represents the selected remedial action for Operable Unit No. Two (Tailings and Waste Rock Remediation) of the Clear Creek/Central City Superfund Site developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Contingency Plan (40 CFR Part 300).

The State of Colorado has been consulted on the Proposed Plan and has indicated that it will concur on the selected remedy for Operable Unit No. Two.

STATEMENT OF BASIS

This decision is based upon the Administrative Record for Operable Unit No. Two of the Clear Creek/Central City Superfund Site. The attached index identifies the items which comprise the administrative record upon which the selection of the remedial action was based.

DESCRIPTION OF SELECTED REMEDY

The Clear Creek/Central City Superfund Site is located approximately 30 miles west of Denver, Colorado and primarily consists of acid mine discharges and milling and mining wastes from five mines/tunnels in the Clear Creek and North Clear Creek drainages. These are the Argo Tunnel and Big Five Tunnel in the Clear Creek drainage; and the Gregory Incline, National Tunnel, and the Quartz Hill Tunnel in the North Clear Creek drainage. Conditions at the five tunnels and tailings and waste rock pile locations pose potential impacts to human health and the environment.

More specifically, potential impacts to human health and the environment resulting from the acid mine discharges include:

- degradation of downstream surface water quality resulting from dissolved and suspended metals in the discharges and resuspended metal laden sediments below the discharges; and

- reduction in aquatic habitat quality or productivity in Clear Creek and North Clear Creek resulting from contaminated surface water.

These impacts were addressed in the September 30, 1987 Record of Decision for the Discharge Treatment Operable Unit or Operable Unit No. One for the site.

Operable Unit No. Two for the site, the Tailings and Waste Rock Remediation Operable Unit, considers potential impacts to human health and the environment resulting from:

- degradation of downstream surface water quality due to collapse of the piles into either Clear Creek or North Clear Creek;

- degradation of downstream surface water quality due to runon and runoff from the tailings and waste rock piles; and

- human uptake of metals from the inhalation of dust or ingestion of material from the tailings and waste rock piles.

These impacts are addressed in this Record of Decision.

EPA is undertaking an additional feasibility study, Operable Unit No. Three or the Blowout/Discharge Control Operable Unit, to evaluate remedial action alternatives for remediating impacts to human health and the environment resulting from a potential blowout of the Argo Tunnel. In addition, the State of Colorado has submitted an application to EPA for monies to fund an investigation to identify other areas within the mining district which may be significantly impacting North Clear Creek and Clear Creek. The State will also investigate the quality of groundwater in the area. Depending upon the results of the State study, EPA may consider additional operable units.

The selected remedy for Operable Unit No. Two consists of slope stabilization at the Big Five Tunnel and Gregory Incline and runon control at all five tailings and waste rock piles. No action will be taken at this time to address potential impacts from inhalation and ingestion of material from the piles.

The unstable slopes at the Big Five Tunnel and Gregory Incline could collapse into Clear Creek and North Clear Creek, respectively, and the resulting metals loading into the creeks would adversely affect the water quality of the creeks. Slope stabilization at the Big Five Tunnel will consist of regrading portions of the piles to a stable configuration and placing large boulders at the base to minimize erosion. The current gabion wall at the Gregory Incline will be maintained until monitoring indicates remediation is necessary or until the tailings are removed for reprocessing. At that time, a permanent solution will be implemented.

Runon control will reduce the metals loading to Clear Creek and North Clear Creek resulting in an improvement of stream water quality. Runon control at all five locations will consist of installing diversion ditches on the upgradient sides of the piles.

No action will be taken at this time to address potential impacts from inhalation and ingestion of material from the piles because the Public Health Evaluation for the site indicated that current or episodic human health and environmental risks resulting from these exposure pathways were minor. Current use consists of periodic visits to the sites by local residents and visitors. The Public Health Evaluation indicated, however, that for a potential future residential scenario, risks resulting from the inhalation and ingestion exposure pathways are of some concern. Therefore, EPA will evaluate this No Action decision when the final remedy is selected for the site. EPA, in coordination with the State of Colorado and local officials, will evaluate the use of institutional measures which would control any human health or environmental threat that could be created by future development upon these tailings and waste rock piles and any other piles which the State identifies in its study. In addition, pursuant to SARA Section 121(c), EPA will review no less than every five years all properties where hazardous substances continue to remain onsite and, if necessary, will reconsider this No Action decision.

Estimated costs for slope stabilization at the Big Five Tunnel and Gregory Incline and runon control at all five sites is approximately $1.0 million.

The selected remedy for Operable Unit No. Two has been chosen to mitigate and minimize potential impacts resulting from the tailings and waste rock piles and to protect human health and the environment. The selected remedy for Operable Unit No. Two is an interim remedy because the net beneficial impact to Clear Creek and North Clear Creek will not be realized until the completion of remedial actions for the other operable units. The selected remedy therefore requires the exercise of the "interim remedy" waiver (SARA Section 121(d)(4)(A)) from contaminant-

specific ARARs listed in the Feasibility Study. The interim remedy waiver allows for the selection of a remedial action that does not attain ARARs if "the remedial action selected is only part of a total remediation action that will attain such level or standard of control when completed." The interim remedy is consistent with the final site remedy. Location- and action-specific ARARs will be met.

DECLARATION

The selected remedy for Operable Unit No. Two of the Clear Creek/Central City Superfund Site is a cost-effective remedy which is protective of human health and the environment. The selected remedy is an interim remedy which does not attain Federal and State public health and environmental requirements that are applicable or relevant and appropriate and therefore the SARA Section 121(d)(4)(A)) interim remedy waiver is required.

The statutory preference for treatment is not satisfied because treatment was found to be impracticable at this time. However, EPA leaves open the opportunity for any future treatment or reprocessing which can be shown to be protective of human health and the environment and which attains Federal and State public health and environmental requirements that are applicable or relevant and appropriate.

James O. Scherer
Regional Administrator
Environmental Protection Agency
Region VIII

March 31, 1988
Date

SUMMARY
FOR THE
RECORD OF DECISION

SITE NAME AND LOCATION

Clear Creek/Central City Superfund Site
Clear Creek and Gilpin Counties, Colorado
Operable Unit No. Two
Tailings and Waste Rock Remediation

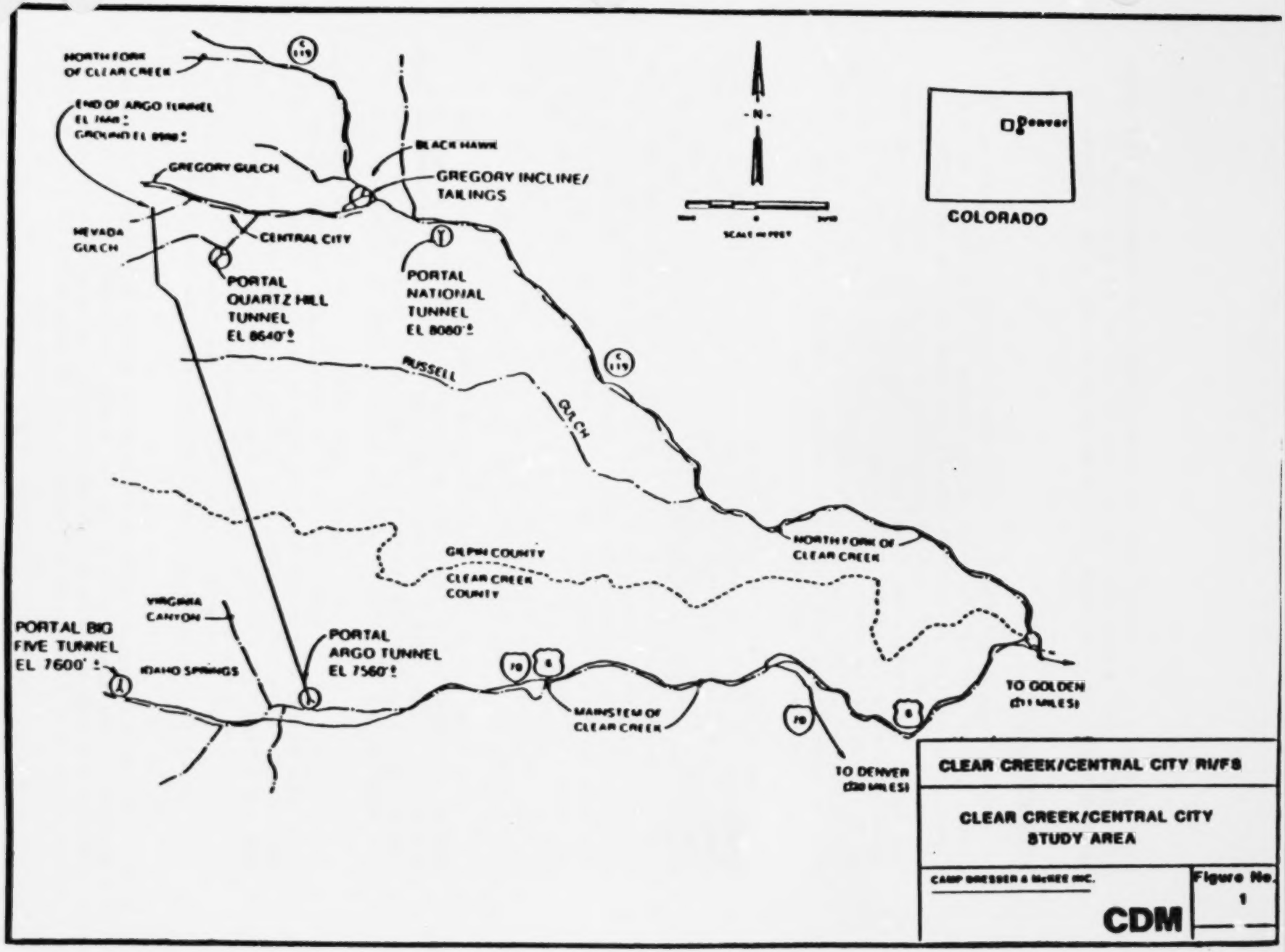
SITE DESCRIPTION

The Clear Creek/Central City Superfund site is located approximately 30 miles west of Denver, Colorado, and primarily consists of acid mine drainages and milling and mining wastes from five mines/tunnels in the Clear Creek and North Clear Creek drainages. The site encompasses the northeastern portion of Clear Creek County and southeastern portion of Gilpin County.

Specifically, the focus of the Remedial Investigation was five abandoned mines/tunnels proximal to the cities of Idaho Springs, Black Hawk, and Central City (Figure 1). The tunnels are the Argo Tunnel and Big Five Tunnel in the Clear Creek drainage and the National Tunnel, Gregory Incline, and the Quartz Hill Tunnel in the North Clear Creek drainage. The Argo portal is within the city limits of Idaho Springs. The Big Five portal borders the Idaho Springs city limits. The Gregory Incline is within the Black Hawk city limits. The National Tunnel is within a mile of the City of Black Hawk. The Quartz Hill Tunnel is within a mile of the City of Central City.

The waste rock/tailings piles considered in this Operable Unit were selected based on their location close to the acid mine discharges. Currently, the major impacts on the water quality of Clear Creek are the Big Five and Argo mine tunnel discharges. The water quality of North Clear Creek is affected by the National Tunnel discharge and seepage from the Gregory Incline and the Quartz Hill Tunnel. The discharges from the five sites were addressed in Operable Unit No. One.

In addition to direct discharge from the mine tunnels, contaminated water may enter the creeks during overland sheet flow. Overland runoff occurs during rapid snow melt and thunderstorms. The resulting surface flow across the tailings and waste rock piles dissolves soluble minerals and transports particulate tailings and waste rock material into the creeks. These mechanisms result in elevated creek acidity and metal loads. The introduction of tailings and waste rock into the


NORTH FORK OF CLEAR CREEK
END OF ARGO TUNNEL
EL 7460 ±
GROUND EL 8980 ±
GREGORY GULCH
BLACK HAWK
GREGORY INCLINE/ TAILINGS
NEVADA GULCH
CENTRAL CITY
PORTAL QUARTZ HILL TUNNEL EL 8640' ±
PORTAL NATIONAL TUNNEL EL 8080' ±
RUSSELL GULCH
GILPIN COUNTY
CLEAR CREEK COUNTY
NORTH FORK OF CLEAR CREEK
VIRGINIA CANYON
PORTAL BIG FIVE TUNNEL EL 7600' ±
IDAHO SPRINGS
PORTAL ARGO TUNNEL EL 7560' ±
MAINSTEM OF CLEAR CREEK
TO GOLDEN (11 MILES)
TO DENVER (28 MILES)
N
SCALE IN FEET
Denver
COLORADO
CLEAR CREEK/CENTRAL CITY RI/FS
CLEAR CREEK/CENTRAL CITY STUDY AREA
CAMP DRESSER & McKEE INC.
CDM
Figure No. 1

creeks could also occur due to catastrophic collapse of tailings and waste rock piles during a flash flood or as a result of undercutting of the base of the pile under any flow regime.

SITE HISTORY

The Clear Creek/Central City hard rock mining district is historically one of the most mined areas in Colorado. At one time, gold mining accounted for 85 percent of the activity, silver for 10 percent and other minerals, (e.g., copper, lead, and zinc) the remaining 5 percent. The area includes over 800 abandoned mine workings and tunnels. Recent data indicate that up to twenty-five mines and six milling operations are currently operating in Gilpin and Clear Creek counties. The intensity of mining operations has varied in recent years, due largely to fluctuating market prices for precious metals.

Mining activity in the Central City/Black Hawk area commenced in 1859. Placer gold was found at the mouth of Chicago Creek, near Idaho Springs, in January of 1859 and, in May of the same year, the first lode discovery in the Rockies was made in Gregory Gulch between Central City and Black Hawk. Initially, mining was concentrated in the Gregory Gulch area, including the Gregory Incline. Exploration via adits and shafts rapidly expanded to the south and west of Central City. Excavation of the Quartz Hill Tunnel was begun in 1860, largely for the purpose of transporting ore from the overlying surface Glory Hole Mine to mills in Central City. The tunnel is over a mile long. National Tunnel construction was initiated in 1905 and continued to 1937. The tunnel is believed to be over 3,100 feet in length.

The Argo Tunnel was constructed from 1893 to 1904. The tunnel was built for the dual purpose of mine drainage and ore transport. The total tunnel length is 4.16 miles, extending from the portal in Idaho Springs in a northward direction to beneath the headwaters of Gregory Gulch, west of Central City.

In July, 1982, the Clear Creek/Central City site was ranked as Site No. 174 on the Interim Priorities List of 400 sites. The site was added to the final National Priorities List (NPL) in September, 1983. EPA began the Remedial Investigation (RI) of the site in July, 1985. The RI Report was issued in June, 1987 and reported results from the study period of July, 1985 through December, 1986. An addendum to the RI was issued in January, 1988 to report results from additional studies conducted in April and May, 1987.

A removal action was conducted by EPA's Emergency Response Branch at the Gregory Incline in March, 1987 to protect human health and the environment from hazards associated with the collapse of a retaining crib wall. A collapse would have allowed

the tailings to slide into North Clear Creek and EPA was concerned that a large load of metals-laden tailings would wash downstream into Clear Creek and contaminate the municipal water supply of the City of Golden, Colorado. EPA removed an old deteriorated crib retaining wall and decreased the slope of the tailings pile to stabilize it. EPA then constructed a gabion-basket retaining wall.

SCOPE AND ROLE OF THE OPERABLE UNIT

During the course of the RI, EPA determined, in accordance with 40 CFR Section 300.68(c), that the Feasibility Study (FS) should be divided into Operable Units in order to remediate site-specific problems.

The Operable Units include:

Operable Unit No. One - Mine Tunnel Discharge Treatment
(Record of Decision signed in September, 1987)
Operable Unit No. Two - Tailings and Waste Rock Remediation
Operable Unit No. Three - Blowout/Discharge Control

In addition, the State of Colorado has submitted an application to EPA for monies to fund an investigation to identify other areas within the mining district which may be significantly impacting North Clear Creek and Clear Creek. The State will also investigate the quality of the groundwater in the area. Depending upon the results of the State study, EPA may consider additional operable units.

SITE CHARACTERISTICS

A public health evaluation was conducted to identify compounds which could pose a significant threat to human health and the environment. Based on sampling of environmental media and consideration of toxicity, twelve contaminants of concern were identified and potential exposure pathways were analyzed. Impacts on human health and the environment were assessed for exposures due to inhalation and ingestion of material from the piles and due to runoff from the piles and catastrophic slope failure of the piles into the streams.

As stated, twelve contaminants were identified during the public health evaluation as contaminants of concern in the Clear Creek/Central City study area. Contaminants of concern were chosen separately for human receptors and aquatic organisms. Arsenic, chromium (VI), and nickel are present in relatively high concentrations in the tailings and waste rock and have been rated by EPA as Group A human carcinogens by the inhalation pathway. Cadmium is a Group B1 carcinogen by inhalation and is a potent

kidney toxin when ingested. Lead and silver are toxic noncarcinogens and are present in relatively high concentrations in the tailings and waste rock.

Contaminants of concern for aquatic life were chosen based on their concentration in water, published criteria values (e.g., Ambient Water Quality Criteria (AWQC)), and supplemental data for chemicals that lacked criteria. Contaminants include aluminum, arsenic, cadmium, chromium, copper, fluoride, lead, manganese, nickel, silver, and zinc.

Exposure to metals in tailings or waste rock can potentially occur through inhalation of dust by people at or near the sites. Two mechanisms for dust generation were considered in the evaluation: (1) dust resulting from wind entrainment of tailings or soil particles; and (2) dust generated from human activities (in particular, riding of dirt bikes on the tailings piles). The Gregory tailings pile is readily accessible and in some areas is quite compacted or has a surface crust. Dirt-bike riding is known to occur at the Gregory tailings pile. The Argo tailings are also readily accessible and are less compacted and more friable than the Gregory tailings. The Argo tailings are not used extensively by dirt-bike riders due to their steepness. Currently, however, waste rock at Argo is being removed for use in constructing roads. This activity, which involves operation of dump trucks and front-end loaders, increases dust emissions from this area.

In addition to inhalation, exposure to metals in soil or tailings can also occur by incidental ingestion. Tourists visiting the mines may contact the tailings, although the potential for significant exposure is low. Older children living in the area, particularly those from ages 6 to 16 who have less parental supervision than younger children, may play or ride dirt bikes at the tailings piles especially during the summer months when school is out.

Future use of the sites may include residential development. Under this scenario, potential exposure pathways would include incidental ingestion of contaminated material by the residents over their life time. This potential future use residential exposure scenario was also evaluated.

In summary, the major potential impacts at the site due to tailings and waste rock are:

- Degradation of surface water quality caused by runoff from the piles;

- Degradation of surface water quality caused by collapse of the piles into the creeks; and,

- Human uptake of metals through inhalation or ingestion.

Exposure to humans

Under both current land use conditions and potential future use scenarios, the principal potential pathways by which human receptors could be exposed to site cor aminants from the tailings and waste rock piles is through inhalation or ingestion of material from the piles. Impacts resulting from ingestion of surface water were evaluated as part of Operable Unit No. One.

Exposure scenarios for average and maximum plausible cases were developed for both the inhalation and ingestion potential exposure pathways. Based on estimates of exposure and a quantitative description of each contaminant's toxicity, human health risks were then assessed. The major conclusions of this assessment are presented in Table 1 and can be summarized as follows:

- Inhalation of wind-entrained dust from the Gregory Tailings pile results in upperbound lifetime excess cancer risks of 7×10^{-6} and 3×10^{-5} for the average and maximum plausible cases, respectively, primarily from exposure to arsenic. Inhalation of wind-entrained dust from the Argo Tailing pile results in upperbound lifetime excess cancer risks of 2×10^{-5} and 3×10^{-5}, for the average and maximum plausible cases, respectively. Generation of dust by dirt bikes ridden at the Gregory Tailings piles results in upperbound risks of 5×10^{-6} and 1×10^{-4}, for the average and maximum plausible cases, respectively. Risks from inhalation of dust from the other tailings and waste rock piles are similar.

- Ingestion of arsenic-contaminated material from the tailings and waste rock piles under current use, or the episodic exposure scenario, poses an upperbound lifetime excess cancer risk of 2×10^{-5} for the average case and 1×10^{-4} under maximum plausible conditions.

- Ingestion of arsenic-contaminated material from the tailings and waste rock piles under the potential future use residential scenario poses an upperbound lifetime excess cancer risk of 1×10^{-4} under average conditions and 9×10^{-4} under maximum plausible conditions.

The risks for individual sites are provided in Table 1 and a more detailed discussion of these exposure pathways and the resulting risks can be found in the Public Health Evaluation,

TABLE 1

SUMMARY OF RISK ASSESSMENT RESULTS FOR HUMAN EXPOSURE TO CONTAMINANTS AT THE CLEAR CREEK/CENTRAL CITY SITE

Exposure Pathway	Total Excess Upper-Bound Lifetime Cancer Risk	
	Average Case	Maximum Plausible Case
Inhalation of Dust Entrained by Wind		
Gregory	7×10^{-6}	3×10^{-5}
Argo	2×10^{-5}	3×10^{-5}
Inhalation of Dust Generated by Motorcycles		
Gregory	5×10^{-6}	1×10^{-4}
Incidental Ingestion of Soil and Tailings Episodic Exposure		
Gregory	2×10^{-5}	1×10^{-4}
Argo	2×10^{-5}	1×10^{-4}
Big Five	1×10^{-5}	8×10^{-5}
National	2×10^{-5}	1×10^{-4}
Quartz Hill	2×10^{-5}	1×10^{-4}
Incidental Ingestion of Soil and Tailings Residential Exposure		
Gregory	1×10^{-4}	6×10^{-4}
Argo	1×10^{-4}	6×10^{-4}
Big Five	8×10^{-5}	4×10^{-4}
National	1×10^{-4}	6×10^{-4}
Quartz Hill	1×10^{-4}	6×10^{-4}

Section 10 of the Remedial Investigation Report. Impacts on aquatic life due to catastrophic slope failure and runoff during storm events are discussed in the following paragraphs.

Exposures to Aquatic Life

The exposure of aquatic life in Clear Creek and North Clear Creek were considered. The principal potential pathways by which the tailings and waste rock piles impact aquatic life are:

- Degradation of surface water quality caused by collapse of the piles into the creeks; and
- Degradation of surface water quality caused by runoff from the piles.

Catastrophic Slope Failure:

The failure of a slope results in movement of a mass of waste rock and/or tailings into the adjacent creek. If these materials are reactive or toxic and are introduced into a water or air stream, where exposure to environmental or human receptors can occur, then a hazard exists. The potential for catastrophic slope failure was assessed for each site.

Argo Tunnel: A geotechnical evaluation was performed on the waste rock/tailings pile at the Argo Tunnel and Mill. The evaluation concluded that the toe of the slope behind the commercial buildings had been cut away and the slope was marginally stable and increased weakness could result from further activities or disturbance. A slope failure would impact the buildings but materials would probably not reach Clear Creek. The volume of such a failure was estimated at 11,200 cubic yards (cy).

Big Five Tunnel: A geotechnical engineering evaluation was conducted on two mine waste rock piles (one on the north side of Clear Creek and one on the south side) created from material excavated from the Big Five Tunnel. The conclusions of these evaluations included:

- The eastern portion of the waste rock pile on the north side of Clear Creek and the western portion of the waste rock pile on the south side of Clear Creek are marginally stable to unstable;
- A 100-year flood could erode the toe of existing slopes back seven to ten feet and decrease slope stability. A 500-year flood could erode the slope back an additional two feet; and,
- All slopes are subject to erosion if left exposed.

Based on the results of the geotechnical investigations, volumes of marginally stable and unstable mine waste rock have been calculated to be 2000 and 6200 cy for the north and south banks, respectively. In addition, the volumes of waste rock which could become marginally stable or unstable after seven to ten feet erosion back from the toe of the existing waste piles due to a 100-year flood were also determined. The volume was calculated to be 7200 and 7900 cy for the north and south banks, respectively.

Quartz Hill and National Tunnel: The waste rock pile adjacent to the National Tunnel is considered stable. Some slopes near the Quartz Hill Tunnel are marginally stable and some minor recontouring is recommended.

Gregory Incline: In 1987, the tailings pile at the Gregory Incline was recontoured to a 2:1 (horizontal to vertical) slope and a gabion-basket retaining wall was constructed. The gabion-basket wall is partially immersed in creek water and is exposed to acid drainage. Without maintenance, the wall has an estimated life of five years. The wall is supporting an estimated 1,100 cubic yards of tailings which would otherwise collapse into North Clear Creek.

More details on the geotechnical evaluations conducted at the Clear Creek/Central City Superfund Site can be found in Section 8 of the Remedial Investigation Report and Section 5 of the Addendum to the Remedial Investigation Report.

Estimated Impact Due to Catastrophic Collapse:

A computer model was used to predict water quality in Clear Creek and North Clear Creek in the assessment of human health and environmental impacts resulting from the catastrophic failure of the Big Five Tunnel and Gregory Incline waste rock and tailings piles. The collapse of the Big Five waste rock piles was modeled under realistic, worst case conditions. In particular, a total of 8,200 cubic yards of material (both north and south banks collapse) was instantaneously introduced into Clear Creek during normal low flow (40 cubic feet per second (cfs)). The 8,200 cubic yards is the quantity of material currently unstable and which could collapse into Clear Creek at any time, including during low flow conditions. Zinc and aluminum were selected to represent the variety of geochemical behavior expected from the twelve identified contaminants of concern. Arsenic was not modeled because measured concentrations in the streams and leachates were below detection limits. Lead and copper were not modeled because leachate concentrations were low.

A collapse of the Big Five pile into Clear Creek would result in a peak dissolved concentration of 1,000 ug/L of aluminum at the point of collapse. After one day, the

contamination would reach Golden where a maximum concentration of 730 ug/L of aluminum is predicted. The aluminum concentration at Golden under ambient conditions is 200 ug/L. A collapse of the Big Five pile would result in a maximum dissolved concentration of 1,100 ug/L of zinc at the collapse point, an increase from 400 ug/L of zinc under ambient conditions. This translates into a maximum concentration of 960 ug/L of zinc at Golden after two days which would gradually decrease to 400 ug/L after eight days. The zinc concentration at Golden under ambient conditions is about 300 ug/L. The modeling results indicate that maximum concentrations of aluminum and zinc would exceed AWQC in all stream segments down to Golden. At Golden, the AWQC would be exceeded by a factor of 24 and 89, respectively for aluminum and zinc. Based on the modeling of zinc and aluminum, it is estimated that concentrations of selected parameters in Clear Creek at Golden would also exceed maximum contaminant levels (MCLs) established under the Safe Drinking Water Act. The results of the model clearly indicate an adverse impact on Clear Creek due to collapse of the waste rock piles at the Big Five Tunnel.

Similar analyses of collapse of the Gregory Tailings into North Clear Creek have been performed. Results from this effort indicate that both AWQC and MCL values would be exceeded in Clear Creek at Golden as a result of a collapse.

Impact Due to Runoff:

In addition to collapse of the tailings and waste rock piles, materials will also enter the stream due to runoff from the piles during snow melt and storm events. The results of the analyses of samples taken on Clear Creek and North Clear Creek during storm events indicate that the average total aluminum and zinc concentrations exceeded AWQC values by factors of 69 and 15 times, respectively. The results indicate potential impact on aquatic life due to runoff during storm events. Impacts on human health due to runoff from the sites are minimal because the storm events are of limited duration.

Summary of Exposures to Aquatic Life:

The major conclusions of the assessment of exposure to aquatic life can be summarized as follows:

- Several of the chemicals of concern are at concentrations that exceed the ambient water quality criteria for the protection of freshwater aquatic life (AWQC). In particular, concentrations of zinc, copper, and aluminum consistently exceed the acute and chronic AWQC. In addition, concentrations of manganese in the water exceed the lowest observed effect level in rainbow trout. Because aquatic organisms are exposed to a mixture and not

individual chemicals, toxic effects may be even greater than indicated by comparison to the AWQC. Although some fish may tolerate the chemicals in the creeks, it is highly unlikely that the populations of fish found in these creeks are free of toxic effects.

A more detailed discussion of these exposure pathways and the resulting risks can be found in the Public Health Evaluation, Section 10 of the Remedial Investigation Report. It is clear that a release or substantial threat of release of a hazardous substance or pollutant or contaminant into the environment has occurred at the Clear Creek/Central City Superfund site and that remedial action is justified.

COMMUNITY PARTICIPATION

On October 26, 27, and 28, 1987, announcements for the public comment period and the public meeting to be held concerning the Operable Unit No. Two Feasibility Study (FS) were published in the Weekly Register Call, the Golden Transcript, and the Clear Creek Courant. The ads announced the November 9 through December 8, 1987 public comment period and the November 24 public meeting, gave a brief description of the remedial action alternatives, and stated the rationale for the Proposed Plan. The press release, along with the Proposed Plan, was mailed to the approximately 300 names on the EPA-compiled Clear Creek/Central City Superfund Site mailing list.

The press release notified the public of the availability of the Administrative Record for the site and informed them of location of the information repositories which had previously been established for the site. Those information repositories are located at the EPA library in Denver, the Gilpin County Court House in Central City, the Idaho Springs Public Library and the Idaho Springs City Hall in Idaho Springs, and the Golden Public Library in Golden, Colorado. The Administrative Record is located at the Gilpin County Courthouse and the EPA Library. An index of the Administrative Record is located at each information repository and is also attached to this Record of Decision.

On November 24, 1987, EPA held a public meeting concerning the Operable Unit No. Two FS and the Proposed Plan. Approximately 50 people attended. Major concerns raised were how EPA's presence in the area was affecting the economy of the area, the perceived large amounts of money which EPA is spending on studying the site, and whether remedial action at the site is warranted. At the request of several who attended the public meeting, EPA extended the public comment period on the Operable Unit No. Two FS to December 18, 1987 and assured concerned individuals that late comments would be accepted up until the decision was made (late March).

The Operable Unit No. Two Responsiveness Summary contains the official transcript of the public meeting, describes in more detail the nature and level of the community's concern, and includes EPA's responses to all comments received during the public review of the Operable Unit No. Two FS.

ENFORCEMENT

A responsible party search for the Clear Creek/Central City Superfund Site has been initiated. The search has revealed information on ownership of the mine tailings and waste rock piles. At this time, however, this search has not been completed. EPA does not feel that response actions should be delayed pending finalization of the responsible party search. Upon finalization of the search, the status of responsible parties will be determined and evaluated and, if appropriate, EPA will formally notify them of the selected remedy for Operable Unit No. Two and will initiate negotiations for the implementation of the remedy. If the potentially responsible parties do not formally commit to performing the remedy in a timely manner, or if no potentially responsible parties are found, EPA will proceed with a Fund-financed remedial design and remedial action and will attempt to recover EPA's response costs from the responsible parties.

IDENTIFICATION AND SCREENING OF ALTERNATIVES

The EPA evaluated potential remedial action alternatives to abate the threat posed by contamination from the five mine tailing and waste rock piles by progressing through the series of analyses which are outlined in the National Contingency Plan (NCP), in particular, 40 CFR Section 300.68, the Interim Guidance on Superfund Selection of Remedy, December 24, 1986, (OSWER Directive No. 9355.0-19) and the Additional Interim Guidance for FY '87 Records of Decision, July 24, 1987, (OSWER Directive No. 9355.0-21). This process, in part, enables the EPA to address the SARA Section 121 requirements of selecting a remedial action that is protective of human health and the environment, that is cost-effective, that attains Federal and State requirements that are applicable or relevant and appropriate, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Additionally, SARA Section 121 and the guidance documents referenced above require that EPA give preference to remedies which employ treatment which permanently and significantly reduces the mobility, toxicity, or volume of hazardous substances as their principal element.

The selection of remedy process begins by identifying certain site-specific information to be assessed in determining the types of response actions that will be considered for the site. A general list of site-specific information is contained in Section 300.68(e)(2) of the NCP. This list was used to identify specific site and waste characteristics for Operable Unit No. Two of the Clear Creek/Central City site. Based upon these site and waste characteristics, the EPA was able to reduce, from the universe of many possible response actions, a set of response actions and associated technologies to be considered for Operable Unit No. Two.

Section 121(b)(1) of SARA requires that an assessment of permanent solutions and alternative treatment technologies or resource recovery technologies that, in whole or in part, will result in a permanent and significant decrease in the toxicity, mobility, or volume of the hazardous substance, pollutant, or contaminant be conducted. The alternative treatment and resource recovery technologies considered included chemical fixation and reprocessing.

The next step of the selection of remedy process is assembling the technologies and/or disposal options into remedial action alternatives. Pursuant to OSWER Directive No. 9355.0-19, "Interim Guidance on Superfund Selection of Remedy", remedial action alternatives were considered ranging from those that would eliminate the need for long-term management (including monitoring) at the site to alternatives involving treatment that would reduce mobility, toxicity, or volume as their principal element. Remedial action alternatives developed in this way will vary mainly in the degree to which they rely on long-term site management. Further, a no action alternative was developed as required by Section 300.68(f)(1)(v) of the NCP.

The remedial action alternatives developed in the Feasibility Study for Operable Unit No. Two for the Clear Creek/Central City site are:

No Action
Slope Stabilization and Runon Control
Capping
Off-site Disposal
Chemical Fixation
Reprocessing

Alternatives were subjected to an initial screening to narrow the list of potential remedial actions for further detailed analyses using the criteria of cost, effectiveness, and implementability (acceptable engineering practices) as directed by 40 CFR Section 300.68(g). A description of each alternative follows along with the results of the initial screening analysis.

No Action Alternative

Under the No Action Alternative, there would be no monitoring activities and no new barriers would be constructed to restrict access to the tailings and waste rock piles. The analysis of the No Action Alternative analysis was summarized earlier in this document in the section entitled "Current Site Status". The evaluation indicated that potential human health and environmental impact could result from the tailings and waste rock piles. In particular, catastrophic failure and runoff could affect aquatic life and downstream water users. In addition, ingestion of tailings or waste rock may have some effects on human health under the future residential use scenario. The No Action Alternative serves as a baseline and was retained for further analysis and consideration as required by Section 300.68(f)(1)(v) of the NCP.

Slope Stabilization and Runon Control Alternative

Slope stabilization measures eliminate or reduce contamination of surface water resulting from collapse of tailings and waste rock piles into the stream. Slope stabilization measures can include excavation, grouting and construction of retaining walls. In addition, contamination of surface water resulting from sheet flow over the piles can be reduced by providing runon control to the piles. Runon control can include diversion ditches around the piles or culverts through the piles.

Initial assessments indicated that slope stabilization and runon controls are effective and can be implemented. Therefore, these alternatives were considered further in the detailed screening of remedial action alternatives. The initial screening of stabilization alternatives identified the following alternatives by site for further study:

Gregory Incline

- Concrete Crib Wall
- Timber Crib Wall
- Box Culvert
- Runon Control

Big Five

- Excavation and Slope Layback
- Erosion Protection at Toe
- Runon Control

National, Argo, and Quartz Hill

- Runon Control

The initial screening evaluation indicated that grouting and retaining walls at the Big Five were not technically feasible. These alternatives were eliminated and not considered in the detailed screening.

Capping Alternative

Surface control measures will eliminate contamination of surface water due to runoff from the mine tailings and waste rock sites and prevent human exposure through inhalation and ingestion. Such measures could include regrading the site to stabilize existing slopes and control surface water runoff, providing a containing cap over the tailings and waste rock material, or revegetation of the site.

Six types of caps were evaluated for each site including synthetic liners, bituminous pavement, soil cement layers, soil cover, clay barrier/soil cover, and a modified Resource Conservation and Recovery Act (RCRA) cap - a frost-resistant clay barrier/soil cover).

The capping analysis indicated that containment is effective, technically feasible and can be implemented. Therefore, these alternatives were considered further in the detailed screening of remedial action alternatives. The initial screening resulted in the following capping alternatives for further evaluation:

National Tunnel

- Synthetic liner
- Soil cement cover

Argo Tunnel

- Synthetic liner
- Soil cement cover

Gregory Incline

- Replacement of existing gabion wall
- Synthetic liner or soil cement cover

Quartz Hill Tunnel

- Pavement of parking lots
- Synthetic liner or soil cement cover

Big Five Tunnel

- o South Side of Clear Creek - Remove to north side of creek or off- site disposal.
- o North Side of Clear Creek - Synthetic liner or soil cement cover.

Various caps were eliminated during the initial screening. Those caps screened out included soil cover, clay barrier/soil cover, bituminous cover and modified RCRA cap. Most of these covers could not be implemented on the steep slopes. More details concerning the screening evaluation can be found in Section 2 of the Feasibility Study Report.

Off-Site Disposal Alternative

The off-site disposal alternative considers the option of transporting the mine tailings and waste rock material to either a local municipal landfill or to a RCRA permitted landfill.

The most likely municipal landfill would be a facility operated by Browning Ferris Incorporated (BFI) near 88th and Tower Road northeast of Denver. This is a relatively new facility which replaces a BFI facility along Colorado State Highway 93 between Golden and Boulder, which has now been closed. The primary concern with this alternative, however, would be whether or not the appropriate regulatory agencies or the operator would allow disposal of materials from a CERCLA site at a municipal landfill even if it was not a RCRA characteristic waste. A second concern would be the impact of such a large volume of material on a landfill designed primarily for municipal use.

The second alternative for disposal of the material is landfill at a permitted RCRA landfill. Three sites were investigated, including the new Last Chance site, operated by BFI near Limon, Colorado; the U.S. Ecology disposal site near Beatty, Nevada; and the USPCI disposal site at Grassy Mountain, Utah. Construction of the BFI site has not yet begun, but will probably commence within the next year. The BFI site is scheduled to provide cells of approximately 158,000 cubic yard capacity. Several of these cells could be dedicated to disposal of the Clear Creek mining waste. The U.S. Ecology and USPCI sites are presently in operation.

The off-site disposal analysis indicated that off-site disposal is a technically feasible alternative that is effective and can be implemented. Therefore, this alternative was considered further in the detailed analysis of remedial action alternatives.

Chemical Fixation Alternatives

Modifying the chemical environment within the Clear Creek/Central City tailings and waste rock piles is a means of reducing the mobility of metals in the piles. By changing the chemical environment of the tailings through the addition of neutralizing materials, the generation of acid and the subsequent dissolution of metals can be eliminated. Such changes also would limit dust generation and could potentially reduce the impact of direct ingestion.

Several methods exist for the modification of the chemical environment in the piles. The effects on the metal-specific species present will vary according to the technique chosen for modification. The addition of materials with large neutralization (basic) capacity, such as kiln dust, is a common method available for raising the pH of an acidic material with the accompanying "fixation" of metals as metallic hydroxides. This is a cost-effective option but its total effectiveness is limited by the fact that some metals may remain slightly leachable by this method.

Another approach is fixation of contaminant metals by chemical binding with an accompanying physical encapsulation. This is accomplished by the addition of fixation and solidification agents that make the contaminants unavailable to oxidation and leaching. Metals that cannot be fixed by simple pH adjustment respond to this technique. Pozzolans and cements constitute the major portion of these fixation agents. Their addition to an acidic material also causes an increase in pH.

Approximately thirty different fixation agents were evaluated during the screening process. These materials were screened for effectiveness as shown by actual leach results, implementability and cost per unit neutralization capacity. The details of this evaluation are provided in Section 2 of the Feasibility Study. Based on the screening evaluation, fixation appears to be a technically feasible containment option and was, therefore, further investigated in the detailed analysis of remedial action alternatives. In particular, the following techniques/fixation agents were considered:

- Kiln dust
- Three proprietary fixation agents

Each of these fixation agents were subject to bench scale tests. The resulting fixed materials were also tested for effectiveness by using leaching tests. The results of these tests are summarized in the Detailed Analysis Section.

Reprocessing Alternatives

There are many processes that have been developed to remove metals from ores and these processes could potentially be applied to remove toxic metals from the five waste piles. The processes fall into two categories: pyrometallurgical - processes using heat; and hydrometallurgical - processes using water solutions. Facilities using these processes exist in several parts of the country and could potentially reprocess materials from the Clear Creek/Central City site. These processes could also potentially be used at a facility constructed in the Clear Creek/Central City site area.

The screening of technologies for reprocessing of tailings and waste rock piles indicated that flotation as a reprocessing alternative is technically feasible and can be implemented. In addition, reprocessing of Gregory Tailings by gravity separation to recover pyrite is technically feasible. To determine the effectiveness and cost of reprocessing, laboratory bench scale studies were conducted. The results are summarized in the detailed analysis of remedial action alternatives.

Summary of Initial Screening

The following alternatives were considered for remediation of the tailings and waste rock piles:

- No Action
- Slope Stabilization and Runon Control
- Capping (with soil cement or synthetic liners)
- Off-site disposal
- Chemical Fixation (with kiln dust and three proprietary agents)
- Reprocessing (flotation or gravity concentration)

Various options under each alternative were evaluated for effectiveness, implementability and cost. Based on this screening evaluation, options were selected for detailed analyses. The results of the detailed analyses are provided in the next section.

DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

Consistent with Section 300.68(h) of the NCP, the Office of Solid Waste and Emergency Response (OSWER) Directive No. 9355.0-19, and OSWER Directive No. 9355.0-21, the remedial action

alternatives remaining after initial screening were further refined and then subjected to detailed analysis. Detailed analysis of each remedial action alternative entailed evaluation based on the criteria derived from the NCP and SARA. These criteria relate directly to factors mandated by SARA in Section 121, in particular Section 121(b)(1)(A-G). The criteria follow:

- Protection of human health and the environment
- Compliance with legally applicable and/or relevant and appropriate requirements
- Reduction of mobility, toxicity, or volume
- Short-term effectiveness
- Long-term effectiveness and permanence
- Implementability
- Cost
- Community acceptance
- State acceptance

The evaluation of alternatives reflects the mandate to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable, as specified in Section 121 of SARA.

Description of Alternatives

No Action Alternative: The No Action alternative assumes that there will be no remediation of tailings and waste rock piles. The potential impacts on human health and the environment include:

- Collapse of tailings and waste rock piles into Clear Creek and North Clear Creek;
- Runoff from the waste rock and tailings piles contaminating Clear Creek and North Clear Creek; and
- Inhalation or ingestion of material from the piles.

The impact due to potential collapse of the Big Five and Gregory Incline waste rock/tailings piles were evaluated in the section entitled "Site Characteristics". As discussed in that

section, both AWQC and MCLs would be exceeded in Clear Creek and North Clear Creek.

The Site Characteristics section also summarized the effects of runoff during storm events. Actual data indicate that AWQC are exceeded in Clear Creek and North Clear Creek.

In addition to potential impacts due to runoff and collapse, the adverse effects of inhalation of ingestion of material from the piles were evaluated and summarized in the Site Characteristics section (Table 1). Under current (episodic exposure) worst case conditions, the risk for ingestion of soil was $1x10^{-4}$ (one excess cancer death in 10,000 people over a lifetime). Under average conditions, the risk was $2x10^{-5}$. Inhalation of dust under average and worst cases indicated risks of $5x10^{-6}$ to $1x10^{-4}$. Under a potential future use residential scenario, the risk of ingestion under average conditions ranged from $8X10^{-5}$ to $1x10^{-4}$. Under maximum plausible exposure conditions the risk ranged from $4x10^{-4}$ to $9x10^{-4}$.

Slope Stabilization and Runon Control Alternative: Based on the detailed evaluation of criteria cited previously, slope stabilization at the Big Five waste rock piles would be accomplished by excavation, slope cutback and toe rip-rap to prevent erosion and tailings collapse into Clear Creek. Based on detailed evaluation at the Gregory Incline, the current gabion wall would be maintained until monitoring indicates remediation is necessary or until the tailings are removed for reprocessing. At that time, a permanent solution will be implemented. Runon controls such as diversion ditches or culverts would be placed on the upgradient side of all sites.

Slope stabilization would be a permanent solution that eliminates collapse of the tailings and waste rock piles. The potential for catastrophic contamination of Clear Creek and North Clear Creek would be eliminated. The runoff would also be reduced by eliminating runon at the upgradient sides of the piles. No reduction in impact due to dust or ingestion would be achieved.

Capping Alternatives: Results of the screening analysis indicated that because of the steep slopes only two technically feasible capping alternatives exist for waste piles at the National Tunnel and Argo Tunnel: synthetic liners or soil cement covers. Because of the steep slopes at both sites, a soil cover would not remain on a synthetic liner. A bare liner would be extremely susceptible to damage and/or vandalism with frequent replacement required. The soil cement cover retains the natural color of the tailings and waste rock material and is probably preferred by the Colorado Historical Society and local residents over a liner. Thus, a soil cement cover is the preferable

capping alternative which could be implemented at the National Tunnel and Argo Tunnel waste piles.

Before the Gregory Incline can be capped, the temporary gabion wall would be replaced. A timber crib wall is priced comparably with other alternatives and would probably be preferred by the Colorado Historical Society. Alternatives evaluated for capping were a synthetic liner and soil cement cover. The soil cement cover is a permanent cover and is probably preferred by the Colorado Historical Society over other capping alternatives.

The Big Five waste rock pile provides a technical challenge for capping and protection against flood erosion. Physical constraints imposed by the original topography and the location of Clear Creek along one side of the piles dictate that piles would be regraded and rip-rap would be placed for flood protection. The regraded piles would then be covered by a soil cement cap. A synthetic liner could be placed, but no soil cover could be put on the liner.

Capping of the Quartz Hill waste rock pile was evaluated for three areas: parking lots with adjoining side slopes, an area near the tunnel entrance, and all remaining areas from the parking lots to the tunnel portal. The screening analysis indicated that soil cement covers were more feasible than synthetic liners for non-auto traffic areas. Selection of soil cement covers would also probably be preferred by the Colorado Historical Society over a liner. The most feasible capping alternative for the parking lots is paving.

In all cases discussed above, runon and runoff control would be provided. This would consist of ditches upgradient of the capped area to divert water and ditches or culverts below the sites to divert runoff. Capping of the tailings and waste rock piles would be a permanent solution that removes exposure to human health and the environment.

Off-Site Disposal: Under the off-site disposal alternative, tailings and waste rock piles would be excavated and transported for disposal at a municipal landfill site such as the landfill operated by BFI at 88th and Tower Road northwest of Denver. Leachate tests indicate that the tailings and waste rock are not RCRA characteristic waste and therefore do not have to be sent to a RCRA landfill.

Removal of the tailings and waste rock piles is a permanent solution that removes exposure to human health and the environment. Dust control measures must be implemented during excavation and trucks would have to be lined and covered during transportation.

Chemical Fixation: In the initial screening process, kiln dust and three proprietary materials were selected for detailed evaluation. Waste rock/tailings from Gregory and Argo were treated with each of the four selected fixation agents. The resultant fixed materials were then subjected to a series of leaching tests to document the effectiveness of the treatment. In all cases, the fixation agents tested were effective in reducing leachate concentrations. In some cases, leachate concentrations were below AWQC for zinc. However, in one case, the leachate contained extremely high values for aluminum (27,700 ug/L). Because of this result, this fixation agent was eliminated from evaluation. Kiln dust and two proprietary agents were all considered further. Based on cost and leachate quality, kiln dust is the most cost-effective. Kiln dust would be applied at an application rate of approximately 0.58 tons per cubic yard of available tailings and waste rock material. Approximately 9 inches of kiln dust would be mixed in with the top 9 inches of tailings and waste rock material and then compacted.

Fixation of the tailings and waste rock piles is a permanent solution that removes exposure to human health and the environment.

Reprocessing Alternative: The reprocessing alternative considers the tailings and waste rock piles as an economic resource and recovers the inherent monetary value while generating a waste which may not be detrimental to the environment. In order to evaluate this option, a three-phase characterization task was undertaken:

- Evaluating the parameters necessary to process the waste rock/tailings;
- Determining if the resultant waste is a hazardous waste; and
- Performing a cost analysis of all options.

The reprocessing studies were conducted on a bench scale level by International Process Research Corporation of Golden, Colorado. Two options were evaluated, namely:

- Reprocessing of all materials; and
- Reprocessing of all materials less than two inches with disposal of coarse fraction as a waste rock.

The results of these types of tests were evaluated to determine if the tailings and waste rock could be reprocessed. These tests included:

- Tests on characterizing the waste rock with respect to particle size distribution and selected contaminant concentrations (copper, zinc, lead, chromium, and arsenic), total sulfur, and precious metals (silver and gold) in different size fractions;
- Froth flotation tests for recovery of an economic product; and
- Leaching tests on waste rock and new tailings to determine potential environmental impacts.

Results of the tests indicate that the quantities of contaminants remaining in the new waste tailings were significantly reduced. However, leachate concentrations were greater than AWQC for selected contaminants such as zinc.

Reprocessing would be a permanent solution that eliminated collapse of the tailings and waste rock piles. A new waste tailings is produced. Leaching tests show that the new tailings can be disposed in a municipal landfill.

Comparison of Alternatives

Listed in Table 2, in matrix format, are the key criteria considered in evaluating and comparing alternatives. These criteria are specified in J. Winston Porter's memorandum "Additional Interim Guidance for FY '87 Records of Decision," dated July 21, 1987 and include:

- Protection of human health and the environment
- Compliance with legally applicable and/or relevant and appropriate requirements
- Reduction of mobility, toxicity or volume
- Short-term effectiveness
- Long-term effectiveness and permanence
- Implementability
- Cost
- Community acceptance
- State acceptance

Table 2 summarizes the data developed in the Detailed Analysis of Remedial Action Alternatives and provides a comparison for selecting a preferred alternative for each location. The following paragraphs summarize the evaluation criteria for all sites.

No Action: As previously indicated, collapse would result in degradation of stream quality below AWQC and MCLs. Runoff also does not meet AWQC. No action would not reduce the mobility, toxicity or volume of the contaminants.

Stabilization and Runon Controls: Degradation of stream quality due to collapse will be eliminated. Runoff quality will not meet AWQC; however, the volume of runoff will be reduced as a result of runon control. As a result, contamination to the stream will be reduced. Overall mobility of contaminants are reduced. Relative to other alternatives (except no action), this option has the lowest cost. The remediation is not a permanent solution for all contamination and does not eliminate all risks to human health and the environment.

Capping: Runoff quality will meet AWQC. Capping reduces mobility of contaminants. Risks to human health due to inhalation of dust and ingestion of materials are eliminated. Capping is a permanent remediation that removes exposure to human health and the environment.

Off-Site Disposal: Off-site disposal reduces the mobility and toxicity of contaminants on the site. However, the materials are placed in another location and the ultimate volume and toxicity is not reduced. Existing risks to human health and the environment are eliminated. Off-site disposal is a permanent remedy. The cost for off-site disposal is the second highest of the six alternatives evaluated.

Chemical Fixation: Runoff quality will meet AWQC for most parameters. Fixation reduces mobility and possibly toxicity of the contaminants. However, the volume of contaminated material is increased. Fixation is a permanent remedy and eliminates existing risks to human health and substantially reduces risk to the environment.

Reprocessing: Reprocessing will result in new tailings that are not RCRA wastes. However, potential leachates from the waste will exceed AWQC. Reprocessing reduces mobility, toxicity and volume of the contaminants. This alternative is the only option that reduces volume. Reprocessing reduces existing risk to human health and the environment. This option is the most expensive of the six alternatives evaluated even considering the value of the minerals extracted (See Table 2). Overall, reprocessing is a permanent solution that reduces exposure to human health and the environment.

TABLE 2
COMPARISON OF ALTERNATIVES

Criteria	No Action	Stabilization/ Runon Control	Capping	Off-Site Disposal	Chemical Fixation	Reprocessing
Argo Tunnel						
1. Compliance with ARARs	Runoff does not meet AWQC. Collapse would result in degradation below MCLs and AWQC.	Runoff will not meet AWQC.	Runoff will meet AWQC's.	Risks are removed. Disposal will meet RCRA.	Runoff will meet most AWQCs.	Risks are removed. Reprocessed tailings are not RCRA wastes. Leachates will exceed AWQCs.
2. Reduction of mobility, toxicity or volume	No reduction of M,T,V.	Reduces mobility	Reduces mobility of contaminants of concern.	Reduces mobility and toxicity on-site materials are placed in another location.	Reduces mobility of contaminants of concern.	Reduces M,T and V.
3. Short Term Effectiveness	No reduction of existing risks from catastrophic collapse of piles and from runoff or ingestion.	Eliminates some contamination to stream. Can be completed in 6 mo.	Eliminates existing risk to human health and the environment. Capping can be completed in 12-18 months.	Existing risk to human health and the environment are eliminated. Off-site disposal can be completed in two years.	Eliminates existing risk to human health and the environment. Fixation can be completed in 12-18 months.	Eliminates existing risk to human health and the environment. Reprocessing can be completed in 5 to 9 years.
4. Long Term Effectiveness	Does not present a permanent solution to remediating risks from the tailings and waste rock piles.	Does not present a permanent solution to all risks.	Capping is a permanent remedy that eliminates the need for long term site management.	Off-site disposal is a permanent remedy that eliminates the need for long term site management.	Fixation is a permanent remedy that eliminates the need for long term site management.	Reprocessing is a permanent remedy that eliminates the need for long term site management.
5. Implementability	—	Constructed with available equipment	Constructed with available construction equipment.	Constructed with available construction equipment.	Constructed with available construction equipment.	Local mills can be used but are currently inoperable.
6. Cost ($) - Capital - Present Worth 10%	 0 0	 40,000 80,000	 1,969,800 1,969,800	 7,347,800 7,347,800	 1,461,800 1,461,800	 8,5-12,126,800 8,5-12,126,000
7. Community Acceptance	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.
8. State Acceptance	No action is acceptable as an interim solution only.	State's preferred alternative.	Capping should be considered in future studies.	Costs are the major concern.	May be considered in future studies.	State would encourage reprocessing if economically feasible.
9. Overall Protection of Human Health and the Environment	May result in adverse effects due to runoff and direct contact with piles.	Runon control eliminates some of the risk to the environment.	Capping is a permanent solution that removes exposure to human health and the environment.	Off-site disposal is a permanent solution that removes exposure to human health and the environment.	Fixation is a permanent solution that reduces exposure to human health and the environment.	Reprocessing is a permanent solution that reduces exposure to human health and the environment.

TABLE 2 (Cont)
COMPARISON OF ALTERNATIVES

Criteria	No Action	Stabilization/ Runon Control	Capping	Off-Site Disposal	Chemical Fixation	Reprocessing
Big Five Tunnel						
1. Compliance with ARARs	Runoff does not meet AMQC. Collapse would result in degradation below MCLs and AMQC.	Runoff will not meet AMQC.	Runoff will meet AMQC's.	Risks are removed. Disposal will meet RCRA.	Runoff will meet most AMQCs.	Risks are removed. Reprocessed tailings are not RCRA wastes. Leachates will exceed AMQCs.
2. Reduction of mobility, toxicity or volume	No reduction of M,T,V.	Reduces mobility and volume (if reprocessed).	Reduces mobility of contaminants of concern.	Reduces mobility and toxicity on-site materials are placed in another location.	Reduces mobility of contaminants of concern.	Reduces M,T and V.
3. Short Term Effectiveness	No reduction of existing risks from catastrophic collapse of piles and from runoff or ingestion.	Eliminates collapse potential and most cotaminants in the stream; can be completed in 6 mo.	Eliminates existing risk to human health and the environment. Capping can be completed in 12-18 months.	Existing risk to human health and the environment are eliminated. Off-site disposal can be completed in two years.	Eliminates existing risk to human health and the environment. Fixation can be completed in 12-18 months.	Eliminates existing risk to human health and the environment. Reprocessing can be completed in 5 to 9 years.
4. Long Term Effectiveness	Does not present a permanent solution to remediating risks from the tailings and waste rock piles.	Provides a permanent solution to collapse; eliminates most of long term site management.	Capping is a permanent remedy that eliminates the need for long term site management.	Off-site disposal is a permanent remedy that eliminates the need for long term site management.	Fixation is a permanent remedy that eliminates the need for long term site management.	Reprocessing is a permanent remedy that eliminates the need for long term site management.
5. Implementability	—	Constructed with available equipment.	Constructed with available construction equipment.	Constructed with available construction equipment.	Constructed with available construction equipment.	Local mills can be used but are currently inoperable.
6. Cost ($) - Capital - Present Worth 10%	 0 0	 562,100 641,100	 825,700 825,700	 5,654,000 5,654,000	 693,800 693,800	 4,2-6,855,000 4,2-6,855,000
7. Community Acceptance	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.
8. State Acceptance	No Action is acceptable as an interim solution only.	State's preferred alternative.	Capping should be considered in future studies.	Costs are the major concern.	May be considered in future studies.	State would encourage reprocessing if economically feasible.
9. Overall Protection of Human Health and the Environment	May result in adverse effects due to runoff and collapse of waste rock/tailings piles and direct contact with piles.	Stabilization is a permanent solution that eliminates collapse and reduced potential human and environmental exposure.	Capping is a permanent solution that removes exposure to human health and this environment.	Off-site disposal is a permanent solution that removes exposure to human health and the environment.	Fixation is a permanent solution that reduces exposure to human health and the environment.	Reprocessing is a permanent solution that reduces exposure to human health and the environment.

TABLE 2 (Cont)
COMPARISON OF ALTERNATIVES

Criteria	No Action	Stabilization/ Runon Control	Capping	Off-Site Disposal	Chemical Fixation	Reprocessing
Gregory Incline						
1. Compliance with ARARs	Runoff does not meet AWQC. Collapse would result in degradation below MCLs and AWQC.	Runoff will not meet AWQC.	Runoff will meet AWQC's.	Risks are removed. Disposal will meet RCRA.	Runoff will meet most AWQCs.	Risks are removed. Reprocessed tailings are not RCRA wastes. Leachates will exceed AWQCs.
2. Reduction of mobility, toxicity or volume	No reduction of M,T,V.	Reduces mobility	Reduces mobility of contaminants of concern.	Reduces mobility and toxicity on-site materials are placed in another location.	Reduces mobility of contaminants of concern.	Reduces M,T and V.
3. Short Term Effectiveness	No reduction of existing risks from catastrophic collapse of piles and from runoff or ingestion.	Eliminates collapse potential and most contaminants in the stream; can be completed in 6 mo. (processing in 2 yr).	Eliminates existing risk to human health and the environment. Capping can be completed in 12-18 months.	Existing risk to human health and the environment are eliminated. Off-site disposal can be completed in Two years.	Eliminates existing risk to human health and the environment. Fixation can be completed in 12-18 months.	Eliminates existing risk to human health and the environment. Reprocessing can be completed in 5 to 9 years.
4. Long Term Effectiveness	Does not present a permanent solution to remediating risks from the tailings and waste rock piles.	Provides a permanent solution to collapse; eliminates most of long term site management	Capping is a permanent remedy that eliminates the need for long term site management.	Off-site disposal is a permanent remedy that eliminates the need for long term site management.	Fixation is a permanent remedy that eliminates the need for long term site management.	Reprocessing is a permanent remedy that eliminates the need for long term site management.
5. Implementability	—	Constructed with available equipment.	Constructed with available construction equipment.	Constructed with available construction equipment.	Constructed with available construction equipment.	Local mills can be used but are currently inoperable.
6. Cost ($) - Capital - Present Worth 10%	 0 0	 32,500 50,700	 498,300 498,300	 876,400 876,400	 395,800 395,800	 3-3,480,000 3-3,480,000
7. Community Acceptance	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.
8. State Acceptance	No Action is acceptable as an interim solution only.	State's preferred alternative.	Capping should be considered in future studies.	Costs are the major concern.	May be considered in future studies.	State would encourage reprocessing if economically feasible.
9. Overall Protection of Human Health and the Environment	May result in adverse effects due to runoff and collapse of waste rock/tailings piles and direct contact with piles.	Stabilization is a permanent solution that eliminates collapse and reduces potential human and environmental exposure.	Capping is a permanent solution that removes exposure to human health and this environment.	Off-site disposal is a permanent solution that removes exposure to human health and the environment.	Fixation is a permanent solution that reduces exposure to human health and the environment.	Reprocessing is a permanent solution that reduces exposure to human health and the environment.

TABLE 7 (cont)

COMPARISON OF ALTERNATIVES

Criteria	No Action	Stabilization/ Runon Control	Capping	Off-Site Disposal	Chemical Fixation	Reprocessing
National Tunnel						
1. Compliance with ARARs	Runoff does not meet AWQC. Collapse would result in degradation below MCLs and AWQC.	Runoff will not meet AWQC.	Runoff will meet AWQC's.	Risks are removed. Disposal will meet RCRA.	Runoff will meet most AWQCs.	Risks are removed. Reprocessed tailings are not RCRA wastes. Leachates will exceed AWQCs.
2. Reduction of mobility, toxicity or volume	No reduction of M,T,V.	Reduced mobility.	Reduces mobility of contaminants of concern.	Reduces mobility and toxicity on-site materials are placed in another location.	Reduces mobility of contaminants of concern.	Reduces M,T and V.
3. Short Term Effectiveness	No reduction of existing risks from catastrophic collapse of piles and from runoff or ingestion.	Eliminates some contamination to stream; can be completed in 6 mo.	Eliminates existing risk to human health and the environment. Capping can be completed in 12-18 months.	Existing risk to human health and the environment are eliminated. Off-site disposal can be completed in two years.	Eliminates existing risk to human health and the environment. Fixation can be completed in 12-18 months.	Eliminates existing risk to human health and the environment. Reprocessing can be completed in 5 to 9 years.
4. Long Term Effectiveness	Does not present a permanent solution to remediating risks from the tailings and waste rock piles.	Does not present a permanent solution to all risks.	Capping is a permanent remedy that eliminates the need for long term site management.	Off-site disposal is a permanent remedy that eliminates the need for long term site management.	Fixation is a permanent remedy that eliminates the need for long term site management.	Reprocessing is a permanent remedy that eliminates the need for long term site management.
5. Implementability		Constructed with available equipment.	Constructed with available construction equipment.	Constructed with available construction equipment.	Constructed with available construction equipment.	Local mills can be used but are currently inoperable.
6. Cost ($) - Capital - Present Worth 10%	 0 0	 25,200 43,400	 275,100 275,100	 1,809,300 1,809,300	 230,400 230,400	 1,9-3,190,000 1,9-3,190,000
7. Community Acceptance	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.
8. State Acceptance	No Action is acceptable as an interim solution only.	State's preferred alternative.	Capping should be considered in future studies.	Costs are the major concern.	May be considered in future studies.	State would encourage reprocessing if economically feasible.
9. Overall Protection of Human Health and the Environment	May result in adverse effects due to runoff and direct contact with piles.	Runon control eliminates some of the risk to the environment.	Capping is a permanent solution that removes exposure to human health and this environment.	Off-site disposal is a permanent solution that removes exposure to human health and the environment.	Fixation is a permanent solution that reduces exposure to human health and the environment.	Reprocessing is a permanent solution that reduces exposure to human health and the environment.

TABLE 2 (Cont)
COMPARISON OF ALTERNATIVES

Criteria	No Action	Stabilization/ Runon Control	Capping	Off-Site Disposal	Chemical Fixation	Reprocessing
Quarts Hill Tunnel						
1. Compliance with ARARs	Runoff does not meet AWQC. Collapse would result in degradation below MCLs and AWQC.	Runoff will not meet AWQC.	Runoff will meet AWQC's.	Risks are removed. Disposal will meet RCRA.	Runoff will meet most AWQCs.	Risks are removed. Reprocessed tailings are not RCRA wastes. Leachates will exceed AWQCs.
2. Reduction of mobility, toxicity or volume	No reduction of M,T,V.	Reduces mobility.	Reduces mobility of contaminants of concern.	Reduces mobility and toxicity on-site materials are placed in another location.	Reduces mobility of contaminants of concern.	Reduces M,T and V.
3. Short Term Effectiveness	No reduction of existing risks from catastrophic collapse of piles and from runoff or ingestion.	Eliminates some contamination to stream; can be completed in 6 mo.	Eliminates existing risk to human health and the environment. Capping can be completed in 12-18 months.	Existing risk to human health and the environment are eliminated. Off-site disposal can be completed in two years.	Eliminates existing risk to human health and the environment. Fixation can be completed in 12-18 months.	Eliminates existing risk to human health and the environment. Reprocessing can be completed in 5 to 9 years.
4. Long Term Effectiveness	Does not present a permanent solution to remediating risks from the tailings and waste rock piles.	Does not present a permanent solution to all risks.	Capping is a permanent remedy that eliminates the need for long term site management.	Off-site disposal is a permanent remedy that eliminates the need for long term site management.	Fixation is a permanent remedy that eliminates the need for long term site management.	Reprocessing is a permanent remedy that eliminates the need for long term site management.
5. Implementability		Constructed with available equipment.	Constructed with available construction equipment.	Constructed with available construction equipment.	Constructed with available construction equipment.	Local mills can be used but are currently inoperable.
6. Cost ($) - Capital - Present Worth 10%	 0 0	 197,500 219,000	 665,900 882,300	 565,400 565,400	 305,000 521,400	 857,000 - 1,379,000 857,000 - 1,379,000
7. Community Acceptance	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.	No Action is preferred alternative.
8. State Acceptance	No Action is acceptable as an interim solution only.	State's preferred alternative.	Capping should be considered in future studies.	Costs are the major concern.	May be considered in future studies.	State would encourage reprocessing if economically feasible.
9. Overall Protection of Human Health and the Environment	May result in adverse effects due to runoff and direct contact with piles.	Runon control eliminates some of the risk to the environment.	Capping is a permanent solution that removes exposure to human health and this environment.	Off-site disposal is a permanent solution that removes exposure to human health and the environment.	Fixation is a permanent solution that reduces exposure to human health and the environment.	Reprocessing is a permanent solution that reduces exposure to human health and the environment.

SELECTED REMEDY

Description of Selected Remedy

The selected remedy for Operable Unit Two of the Clear Creek/Central City site consists of slope stabilization and runon control.

The Remedial Investigation identified four potential exposure pathways by which the tailings and waste rock piles could impact human health and the environment. These potential pathways are:

- Collapse of tailings and waste rock piles into streams;
- Runoff from tailings and waste rock piles into streams;
- Inhalation of dust from the piles; and
- Ingestion of material from the piles.

Two sites were identified that had tailings and waste rock piles that had the potential to collapse into Clear Creek or North Clear Creek because of unstable slopes. The two sites are the Big Five Tunnel and the Gregory Incline. The Argo Tunnel tailings and waste rock pile was also identified as being unstable because of being undercut. If the Argo waste rock pile fails, the structures below it would be affected, however, the waste rock would not reach Clear Creek. Based on the effects on human health and the environment from the potential collapse of the Big Five waste rock pile into Clear Creek, it is recommended that the slopes on both sides of the creek be regraded and stabilized and that rock rip-rap be placed on the toe to protect the slope from eroding and collapsing into Clear Creek. Based on the effects on human health and the environment from the potential collapse of the tailings and waste rock pile at the Gregory Incline, it is recommended that the gabion-basket wall be maintained until monitoring indicates remediation is necessary or until the tailings are removed for reprocessing. At that time, a permanent solution will be implemented. Specific details concerning the stabilization remedial actions will be developed during Remedial Design. The cost of this remediation is provided in Table 3.

The second exposure pathway is contaminated water from both runoff and runon over the tailings and waste rock piles. Runoff can be controlled by alternatives such as: capping, chemical fixation, reprocessing, and off-site disposal. Because of the high cost to control runoff and the fact that the quantity of runoff, as opposed to runon, from the five sites is small when compared to the total runoff from the mining district (less than 0.01 percent of the total during storm events), no large-scale

TABLE 3

SUMMARY OF COST FOR PREFERRED OPTION

Cost	Slope Stabilization	Runon Control
CAPITAL		
Gregory Incline	$ 0	$ 25,300
National Tunnel	-	19,700
Quartz Hill	-	154,300
Argo Tunnel	-	31,900
Big Five	207,800	231,400
Subtotal	$207,800	$462,600
Engineering, Management and Contingency	$ 58,200	129,500
Total Capital	$266,000	$592,100
OPERATIONS AND MAINTENANCE		
Five Year Evaluation	$ 10,000	$ 10,000
Annual Repair	9,000	25,000[a]
Annual Total (including 20% contingency)	10,800	30,000
Five Year Recurring Total (including 20% contingency)	12,000	12,000
PRESENT WORTH COST		
(Inflation = 4% and Interest = 10%)	330,900	718,700
TOTAL BOTH OPTIONS		$1,049,600

[a] Includes repair of five percent of the total length each year.

remediation to eliminate runoff is proposed. However, runon controls (upgradient ditches) have been incorporated into the proposed remediation. The costs for runon control are shown for all five sites in Table 3. Runon controls will substantially reduce the quantity of water flowing over the waste rock and tailings piles. A detailed evaluation of these quantities is provided in the Operable Unit No. Two FS (Appendix J). Based on the benefit achieved by providing runon control and the relatively small cost of these measures, runon controls are recommended.

When final designs are completed to treat acid mine drainage under Operable Unit No. One, collection and treatment of runoff from tailings and waste rock piles at the treatment facilities will be evaluated.

The third and fourth exposure pathways of concern are ingestion and dust inhalation. As previously discussed, acceptable risks are present for tourists and the occasional site visitors (episodic exposure), therefore, no remedial actions are currently recommended to alleviate ingestion and dust inhalation. However, the Public Health Evaluation for the site indicated that, for a residential scenario, risks resulting from the inhalation and ingestion exposure pathways are of some concern. Therefore, EPA will evaluate this No Action decision when the final remedy is selected for the site. EPA, in coordination with the State of Colorado and local officials, will evaluate the use of institutional measures which would control any human health or environmental threat that could be created by future development upon these tailings and waste rock piles and any other piles which the State identifies in its study. In addition, pursuant to SARA Section 121(c), EPA will review no less than every five years all properties where hazardous substances continue to remain onsite and, if necessary, will reconsider this No Action decision.

Documentation of Significant Changes

EPA identified the Slope Stabilization and Runon Control Alternative as the preferred alternative in the Proposed Plan which was released to the public on November 9, 1987. The key elements of this alternative as stated in the Proposed Plan were runon control on all five tailings and waste rock piles and slope stabilization of the Big Five and the Gregory Incline.

At the time of the release of the Proposed Plan, EPA was proposing to remove the gabion-basket wall at the Gregory Incline and replace it with a crib wall. EPA intended to take the property owner's desire to reprocess tailings at the Gregory Incline into account when replacing the gabion-basket wall. Since that time, EPA has received extensive comment on this portion of the Proposed Plan and has modified the selected remedy to address

these concerns. The primary difference between the preferred remedy as presented in the Proposed Plan and the selected remedy as presented in this Record of Decision is that EPA no longer plans to immediately replace the gabion-basket wall, but will instead maintain the wall until monitoring indicates that the wall needs to be replaced or until the tailings are removed for reprocessing. The EPA will still take the owner's reprocessing concerns into account while monitoring and maintaining the wall.

The selected remedy is a logical outgrowth of the remedy identified in the Proposed Plan and other alternatives developed and evaluated in the Operable Unit No. Two FS. The components of the selected remedy were conceptually evaluated in the FS and the selected remedy is well within the range of alternatives the public could have reasonably anticipated EPA to be considering.

STATUTORY DETERMINATIONS

Protectiveness:

The Public Health Evaluation for the Clear Creek/Central City Superfund Site clearly shows that Clear Creek and North Clear Creek are being impacted by the acid mine discharges and the tailings and waste rock piles which are associated with the site. These impacts include:

- degradation of downstream surface water quality resulting from dissolved and suspended metals in the discharges and resuspended metal laden sediments below the discharges;

- degradation of downstream surface water quality due to potential collapse of the tailings and waste rock piles into either Clear Creek or North Clear Creek; and

- degradation of downstream surface water quality due to runon and runoff from the tailings and waste rock piles.

These impacts pose no immediate danger to public health because the cities of Idaho Springs, Blackhawk, Central City, and Golden have municipal water supply systems that meet MCLs. However, these impacts result in severely degraded water quality affecting aquatic life and productivity and reduced or destroyed aquatic habitat in Clear Creek and North Clear Creek.

The first impact mentioned above is associated with the acid mine discharges and was addressed under Operable Unit No. One. The other two impacts are associated with the tailings and waste rock piles and are addressed in this Operable Unit.

The selected remedy for this Operable Unit includes slope stabilization which will reduce the potential for a collapse of

unstable tailings and waste rock piles into the creeks and runon control measures which will divert water around the piles thereby eliminating the impact due to runon. This portion of the selected remedy is therefore protective and will result in an improvement of the water quality in Clear Creek and North Clear Creek.

The Public Health Evaluation also considered impacts to human health resulting from inhalation or ingestion of material from the tailings and waste rock piles. However, as discussed earlier in this document and as shown in Table 1, there are no current impacts to human health from these exposure pathways. For this reason, the selected remedy for this portion of the Operable Unit, No Action, is protective of human health.

Under the potential future residential use scenario the risk from ingestion of soil is of some concern. For this reason, EPA, when selecting the final remedy, will consider institutional measures to control future development upon the tailings piles.

Consistency With Other Laws:

Pursuant to SARA Section 121(d), remedial actions shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and control of further release which at a minimum assures protection of human health and the environment. In addition, remedial actions shall, upon their completion, reach a level or standard of control for such hazardous substances, pollutants, or contaminants which at least attains legally applicable or relevant and appropriate Federal standards, requirements, criteria, or limitations, or any promulgated standards, requirements, criteria, or limitations under a State environmental or facility siting law that is more stringent than any Federal standard (ARARs).

On December 23, 1986 EPA requested that the State of Colorado provide a list of applicable or relevant State requirements, standards, criteria and limitations for the Clear Creek/Central City Site. The State responded on May 14, 1987 with a list of requirements pertaining to Operable Unit No. One. The State did not formally submit a list of requirements for Operable Unit No. Two. Subsequently, however, probable State requirements were identified by State and EPA staff through informal discussions. These informally identified requirements were taken into account during the development of alternatives for tailings and waste rock remediation.

EPA classified all Federal and State public health and environmental requirements applicable or relevant and appropriate to the tailings and waste rock remediation into three categories: contaminant-specific ARARs, action-specific ARARs, and location-specific ARARs. A description of each of these categories is

provided in Section 2 of the Operable Unit No. Two FS. Tables 2-1 and 2-2 in the FS contain a brief description of each potential Federal and State public health and environmental requirement identified and EPA's analysis of each requirement's applicability or relevance and appropriateness to the operable unit.

EPA has determined that the contaminant-specific ARARs for Operable Unit No. Two are the Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act, Ambient Water Quality Criteria (AWQCs) established under the Clean Water Act and State Water Quality Standards. There are currently no identified contaminant-specific ARARs for metals in soils so EPA relied on action-levels established through the risk assessment. These action levels are contained in Table 2-3 of the Operable Unit No. Two FS.

The selected remedy for Operable Unit No. Two is an interim remedy which is consistent with the final remedy and which, pursuant to SARA Section 121(d)(4)(A), requires the exercise of the "interim remedy" waiver from the contaminant-specific ARARs mentioned in the previous paragraph, that is, the selected remedy is only part of a total remediation that will attain such a level or standard of control when completed. Location- and action-specific ARARs will be met.

In accordance with SARA Section 121(d)(2)(A)(ii), EPA intends that the final remedy will at least attain water quality criteria established under the Acts mentioned above. However, additional data collection and use attainability analyses are necessary for EPA to determine if such criteria are appropriate under the circumstances of the release or whether site-specific modification to the criteria would more appropriately establish clean-up goals for the site. EPA will make this determination as part of the final remedy selection.

Cost-effectiveness and Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable:

The Slope Stabilization and Runon Control Alternative is a cost-effective remedial action alternative which effectively mitigates and minimizes threats to and provides adequate protection of public health and the environment. Other than the No Action Alternative, this is the least expensive alternative of those considered. (See Table 2.) The estimated total cost for the selected remedy is anticipated to be $1,049,600. This cost includes operation and maintenance activities and the cost of the five-year evaluation.

The selected remedy does not satisfy the statutory preference for treatment as a principal element because treatment was found to be impracticable at this time. However, EPA leaves open the opportunity for any future treatment or reprocessing which can be shown to be protective of human health and the environment and which attains Federal and State public health and environmental requirements that are applicable or relevant and appropriate.

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RESPONSIVENESS SUMMARY

CLEAR CREEK/CENTRAL CITY SUPERFUND SITE
CLEAR CREEK AND GILPIN COUNTIES, COLORADO
OPERABLE UNIT NO. TWO
TAILINGS AND WASTE ROCK REMEDIATION

MARCH 29, 1988

FINAL

RESPONSIVENESS SUMMARY

OPERABLE UNIT NO. TWO OF THE

CLEAR CREEK/CENTRAL CITY SUPERFUND SITE

CLEAR CREEK AND GILPIN COUNTIES, COLORADO

March 1988

This Responsiveness Summary for Operable Unit No. Two of the Clear Creek/Central City site was prepared by the U.S. Environmental Protection Agency (EPA) to describe the issues raised by residents of Clear Creek and Gilpin Counties, the Colorado Department of Health, and other interested parties regarding EPA's activities in the area and to summarize EPA's responses to those issues. EPA is conducting a Remedial Investigation and Feasibility Study (RI/FS) at the site to determine the nature and extent of contamination that has resulted from historic mining activities in the area, to develop ways of remediating the contamination found at the site, and, finally, to select the most appropriate remedial actions.

A Responsiveness Summary is required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (the "Superfund" program) as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. The purpose of the Responsiveness Summary is to document public concerns about proposed remedial actions and to present EPA's responses to those concerns. This document summarizes public comments for the period that began with the initiation of the Feasibility Study (FS) for Operable Unit No. Two in June 1987 continuing through the public comment period on the Operable Unit No. Two FS Report. The public comment period closed on December 18, 1987; however, EPA accepted comments through March 1988. This report is divided into the following sections:

Section I. Introduction and Background. This section provides a brief introduction to the site and describes EPA's preferred alternatives for remedial action on Operable Unit No. Two.

Section II. The Community Relations Program at the Clear Creek/Central City Site. This section provides a brief history of community relations activities that EPA has conducted throughout the RI/FS at the site.

Section III. Summary of Public Comments Received and EPA's Responses. This section summarizes comments received by EPA on Operable Unit No. Two, categorized as follows:

- Comments and EPA's Responses. Comments received from inception of the Operable Unit No. Two FS until the selection of remedy was made (in March 1988) and EPA's responses to those comments; and
- Remaining Comments. Comments received for which EPA will provide more complete answers after further study.

Appendix. Chronology of Community Relations Activities at the Clear Creek/Central City Site.

I. INTRODUCTION AND BACKGROUND

Since February 1985, EPA has been investigating public health and environmental risks posed by mining wastes at the Clear Creek/Central City site. The mining wastes are associated with the Argo Tunnel and Big Five Portal on Clear Creek and the National Tunnel, Gregory Incline and Quartz Hill Tunnel in the North Clear Creek drainage. These investigations are part of the RI/FS at the Clear Creek/Central City Superfund site in Gilpin and Clear

Creek Counties. There has been one RI conducted at the site; the FS has been divided into the following operable units:

- Operable Unit No. One, Acid Mine Discharge;
- Operable Unit No. Two, Tailings and Waste Rock Remediation; and
- Operable Unit No. Three, Discharge and Blowout Control.

In addition to the above operable units, the State of Colorado will investigate 1) contamination upstream of the sites and 2) regional ground water contamination. Based on these investigations, remedial actions may be recommended.

The RI Report and the draft FS Report on Operable Unit No. One, which considered mine drainage issues, were completed and released to the public in June 1987. The RI Report describes the results of EPA's investigation of the entire site to date. The draft FS Report on Operable Unit No. One discusses and evaluates methods for cleaning up contaminated mine drainage. The Record of Decision (ROD) for Operable Unit No. One was signed September 30, 1987.

The selected remedy for Operable Unit No. One, mine drainage discharges, included both passive and active treatment of mine drainage. Community response to the Proposed Plan for Operable Unit No. One was guarded -- that is, residents expressed concerns about EPA's plans and actions to solve at great expense problems that residents believe to be minor.

The draft FS Report on Operable Unit No. Two discusses and evaluates methods of remediating contamination resulting from waste rock and tailings piles. Alternatives for remediation of tailings and waste rock contamination were presented to residents in EPA's Proposed Plan, dated November 9, 1987, which was mailed to the approximately 100 individuals on the Clear Creek/Central City mailing list. EPA's major concerns associated with Operable Unit No. Two are potential human and environmental effects resulting from contaminant and sediment loading caused by water running over the

tailings and waste rock piles and into surface water bodies; potential collapse of the piles, which could result in contamination of the stream; and direct contact through inhalation or ingestion of material from the piles.

Six remedial alternatives were considered for remediation of the tailings and waste rock contamination at the five mining tunnels:

- no action;
- slope stabilization and runon control;
- capping;
- off-site disposal;
- chemical fixation; and
- reprocessing.

EPA's selected alternatives vary for each of the mine tunnel locations because of the different conditions at each property. In general, alternatives were selected that would minimize costs and remediate the most critical risks present at the properties.

EPA's selected alternative for dealing with potential tailings collapse at the Gregory Incline and at the Big Five Tunnel is slope stabilization. The gabion wall at the Gregory Incline will be carefully monitored and replaced only if necessary. The selected alternative for dealing with water running over the tailings and waste rock piles and entering the creeks at the five mine portals is to reduce "runon" (water running on to the piles from above) by building diversion ditches above the piles. The selected alternative for inhalation or ingestion of material from tailings and waste rock piles is no action. This is an interim remedy, because some risk exists for possible future residential exposure. EPA will work with State and local officials to evaluate land use controls that will mitigate risks associated with future development.

As with Operable Unit No. One, residents expressed doubts about the need to solve a problem they believe to be minor or nonexistent. Many residents expressed the opinion that EPA's efforts to solve problems at the five mines would not have a significant overall effect on contamination in the area or in the creeks because of the large quantity of waste material elsewhere that would not be addressed during this portion of EPA's work at the site. Many commenters said they would prefer that EPA allow property owners to reprocess the tailings as a means of cleaning them up. Residents also are concerned that EPA's long-term presence will discourage future investment in mining in the area. They dispute the findings of studies done to date indicating that there is an imminent danger of collapse of tailings and waste rock piles and the findings that there may be potential health risks related to inhalation or ingestion of tailings dust.

Several technical activities with high visibility in the community have been conducted thus far. They are described below.

- Gregory Tailings: EPA conducted a removal action at the Gregory Incline and Tailings in March 1987 to prevent the possible collapse of the tailings pile into North Clear Creek. EPA was concerned that collapse of the tailings would wash a large load of metals downstream into Clear Creek and contaminate the Golden municipal water supply that is drawn from Clear Creek.

  EPA decreased the slope of the tailings pile to stabilize it and built a retaining wall. EPA originally planned to build a culvert at the Gregory Tailings through an Expedited Response Action (ERA) in the Fall of 1986. Engineering reports were released in April and June 1986, followed by a public comment period July 7-28, 1986. EPA was unable to proceed with construction at that time, however, due to the shortage of funds that preceded reauthorization of the Superfund program. The temporary retaining wall was built in March 1987 under the EPA Emergency Response program.

- Residential Wells Survey: During the RI, EPA found that shallow ground water, a common source of water for shallow domestic wells, is contaminated in places with metals, including lead, arsenic, cadmium, zinc, copper, nickel, and chromium. In March and April 1987, EPA conducted a survey of area households to discover whether residents were using shallow wells. The survey revealed the existence and use of a few shallow wells, one of which was contaminated with elevated levels of cadmium. EPA informed the owner of that well of the elevated levels of cadmium, and EPA's Emergency Response Branch conducted a Superfund removal action to provide the well owner with clean water from the Idaho Springs municipal water supply.

- Passive Treatment Pilot Project: As part of the remedy for Operable Unit No. One, a pilot project for passive treatment of mine discharge is now underway at the Big Five Tunnel portal. EPA has built a concrete box at the mine portal to treat some of the mine discharge. An artificial wetland has been created in the box to study the efficiency of this technology in reducing the levels of metals and neutralizing the acid drainage. EPA expects to use the results of this project to refine estimates of land requirements for passive treatment and the types of vegetation most suited to this technology for Operable Unit No. One.

II. THE COMMUNITY RELATIONS PROGRAM AT THE CLEAR CREEK/CENTRAL CITY SITE

EPA's community relations activities at the Clear Creek/Central City site began in the fall of 1982 after the site was listed on EPA's interim National Priorities List (NPL) in July 1982. The site was placed on the final NPL in September 1983. Community concern about EPA's activities at the site has tended to be moderate, with occasional periods of high interest caused by

residents' concerns about the action at the Gregory Tailings, the Big Five pilot project, and EPA's plans for the tailings and waste rock piles. In addition, many residents are concerned that two local property owners will be expected to pay for cleanup costs. Many residents do not believe local property owners should be liable for these costs because they did not create the problems. These two land owners purchased the properties after the original mining that created the problems took place. Both of these property owners are private citizens who live near the site and have many friends in the communities. In response to community comments about the local property owners' potential liabilities for their mining properties, EPA representatives have had several conversations with local officials, residents, and the press to listen to concerns and provide information. Much of the community concern expressed at these meetings has focused on residents' beliefs that mine wastes do not present a problem worthy of the high level of attention given to this site. In addition, there is a general antagonism toward other Federal agencies because of mining regulations that area residents believe have restricted mining activity in the area.

On several occasions, new information about ongoing work at the site has been the subject of extensive news and editorial coverage in local newspapers, in particular during EPA's removal action at the Gregory Tailings in the Spring of 1987. Residents expressed concern about the cost and necessity of conducting the work, particularly in light of the possibility that the property owner, a local resident, might have to repay the government later for the costs. The pilot passive treatment project at the Big Five Tunnel portal has been closely followed in the local newspapers as well. Local interest among residents and in area newspapers increased again during the public comment period on the Operable Unit No. Two FS Report on tailings and waste rock piles. In general, citizens have questioned the need for remedial work on the tailings and waste rock piles, which have been in place for many years. Area residents and local newspapers have expressed relatively less interest in the overall mine drainage problem than in the Gregory Tailings or the Big Five Tunnel projects.

In preparing the Revised Community Relations Plan (CRP) completed in January 1986, EPA conducted discussions with local officials and community members in September 1985. The original CRP was prepared in the fall of 1982. To facilitate the flow of information to the communities, information repositories were established at the Gilpin County Court House in Central City, the Idaho Springs Public Library in Idaho Springs, and the EPA Library in Denver in the Fall of 1985. In December 1985, EPA prepared and distributed to residents an initial Fact Sheet describing the site and the potential contaminants of concern.

EPA prepared and distributed a second Fact Sheet in July 1986 regarding the Emergency Removal Action (ERA) planned at the Gregory Tailings for the Fall of 1986. The Agency held a public comment period on the proposed action and held a public meeting with local residents. As described in the Responsiveness Summary prepared for Operable Unit No. One, the ERA was later conducted as a Superfund removal action in the Spring of 1987. Public concern at that time was focused on the cost of the removal action, the potential liability of the property owner (who is a life-long resident of the community), the potential loss of an historic site, and the potential for EPA to conduct other similar actions in the area. During this period, EPA also expanded the number of information repositories to include the Golden Public Library in Golden and the Idaho Springs City Hall in Idaho Springs, to make site-related documents more accessible to the community.

In August 1987, EPA placed the entire Administrative Record for the site in the Gilpin County Court House and the EPA Library. An index to the Administrative Record was placed in all five information repositories. In addition, EPA further revised the CRP and signed a Memorandum of Understanding with the Colorado State Historical Society concerning the Gregory Tailings removal action to assure that the action that EPA undertook at the site was carried out in accordance with State guidelines for preserving historic sites.

The Colorado Historical Society has determined that the Big Five Tunnel portal is eligible to become a national historic landmark. Federal law requires that any Federal agency proposing to undertake work at a location eligible for listing as a national historic landmark demonstrate it has taken into account historic preservation considerations. Thus, EPA submitted to the State Advisory Council on Historic Preservation drawings of the passive treatment system at the Big Five Tunnel portal. Upon recommendation of the Advisory Council, EPA changed the location and materials of the fence to be built around the passive treatment plant. These changes were deemed important in preserving historic aspects of the tunnel.

During the survey of shallow domestic wells in the spring of 1987, EPA prepared a letter to residents and a question-and-answer Fact Sheet -- both designed to provide residents with information about the survey and its purpose -- to be handed out by the individuals taking the survey. EPA representatives also met with local officials and area residents to discuss the survey.

After release in June 1987 of the FS Report on Operable Unit No. One, EPA published a question-and-answer Fact Sheet and held two public meetings in conjunction with the public comment period from June 8 through July 7, 1987. At the first meeting in Central City on June 16, approximately seventeen people attended, and only one person asked a question of EPA. A local property owner later commented to EPA that he thought the public notice for this meeting had been insufficient, and requested an extension of the public comment period. About forty people attended the second meeting on June 17 in Idaho Springs. These people had numerous questions and comments about EPA's plans for the site. Residents again expressed doubt about the necessity of taking action on mine drainages when local people do not perceive them to be causing any problems. They also said that the high cost of the treatment cast further doubt on the need for remediation and expressed concern about the effects of EPA's activities on the local economy. These concerns are

described in greater detail in the Responsiveness Summary prepared for Operable Unit No. One.

The draft FS Report for Operable Unit No. Two, Tailings and Waste Rock Remediation, was released on November 9, 1987. On the same day, EPA published a Proposed Plan for the site, prefaced by an explanatory letter. A public meeting was held on November 24, 1987 in Idaho Springs, Colorado. Prior to the meeting, EPA mailed copies of the Proposed Plan and letter to local residents and officials. Legal announcements of the meeting were published in the Clear Creek Courant (Idaho Springs) on October 28, 1987, in the Weekly Register-Call (Gilpin County) on October 26, 1987, and in the Golden Transcript (Golden) on October 27, 1987. EPA provided these newspapers with press releases that were also published in each of these three newspapers during the week of October 26, 1987. The public meeting occurred midway through the public comment period, on November 24, 1987, and was attended by approximately fifty people. Copies of the Proposed Plan for Operable Unit No. Two were available at the meeting. The atmosphere of the meeting was heated, as residents strongly expressed their doubts about EPA's plans.

Community members attending the meeting had numerous questions and comments regarding EPA's activities in the area. Many of the residents' comments were made in regard to the local economic effects of EPA's activities. Several residents questioned EPA's justification for its activities in the area and the accuracy of findings related to Operable Unit No. Two. Residents were concerned that the cost of EPA's efforts to clean up the mine tailings and waste rock at the five mine tunnels would be excessive in light of the larger volume of such materials elsewhere in the area. Residents' concerns are described in greater detail below.

In response to requests made at the November 24 public meeting for an extension of the comment period, EPA extended the closing date of the comment period by ten days until December 18, 1987. This extension was announced in press releases in the Clear Creek Courant, the Weekly Register-Call, and the

Golden Transcript during the week of December 7, 1987. EPA announced through local media the delay in signing of the ROD on Operable Unit No. Two. The Agency accepted public comment until the final selection was made.

III. SUMMARY OF PUBLIC COMMENTS RECEIVED AND EPA'S RESPONSES

This section summarizes public concerns about the FS Report on Operable Unit No. Two expressed during the public comment period. Community comments generally addressed: issues about the reduction of contamination from waste rock or tailings piles at the five tunnels relative to the total volume of mining wastes in the area, particularly when the costs of this effort are considered; issues about Superfund procedures, studies, and actions, such as cleanup of the Gregory Tailings site; issues about the methods, costs, and conclusions of the studies; issues about local economic impacts of Superfund activities; and technical issues, raised primarily by the Colorado Department of Health.

Many residents expressed concern about the effects of the Superfund process on investment in future mining development. Several residents also commented about the possible loss of the value of the metals in tailings piles because of the liability associated with extracting metals from an NPL site.

Several local officials and two of the owners of mining properties that are part of the Superfund site attended the public meeting held on November 24, 1987 in Idaho Springs. Aside from county and municipal governments, the Clear Creek and Gilpin County Metal Miners' Association (CCGCMMA) is the only citizens' group that has consistently expressed interest in EPA's activities at the site. The CCGCMMA includes a broad membership throughout the two affected counties, as well as areas downstream of the site. As with many of the comments made at the public meeting held for Operable Unit No. One, residents and representatives of the CCGCMMA suggested that EPA evaluate

reprocessing of the tailings piles as a way of reducing public health and environmental risks while providing an economic return to the communities.

A major concern at the site throughout the Superfund process has been the extent to which EPA's Superfund activities may adversely impact local property owners and future prospects for mining. A number of citizens have expressed support for area property owners, both encouraging EPA to limit the financial liabilities for local property owners, and discouraging EPA from destroying or removing the mining wastes before the minerals can be extracted from them. Residents suggested that EPA should reevaluate the need for the cleanup at this site. Residents have consistently suggested that blowout control is important; however, few appear to support the need to clean up or stabilize the tailings and waste rock piles. Blowouts are large releases of mine drainage from mines whose tunnels have been temporarily blocked for a period of time through natural silting or collapse of mine workings. The Argo Tunnel has experienced blowouts in the past, with resulting contamination of Clear Creek downstream to Golden. Residents criticized EPA for continuing its study of mine tailings at the site without considering the length of time the tailings have been in place without any perceived endangerment of human health or the environment.

During the public meetings, EPA responded that it would consider proposals to reprocess the tailings piles and that the proposed remedial alternative would not affect the future economic value of the tailings piles. The Agency has also consistently agreed that blowout control is an important issue and noted that the problem is currently under study.

The first subsection below provides a summary of comments and EPA's responses; the second subsection summarizes remaining comments for which EPA will be able to provide more complete responses after further study.

A. Summary of Comments Received During the Public Comment Period and EPA's Responses

This section categorizes questions and comments received during the public comment period and EPA's responses to those comments in the categories below:

- Policy Issues;
- Study Methods and Findings;
- Government and Superfund Procedures and Activities; and
- Economic Issues

1. Policy Issues

- Comment: Two commenters asked what the cost of EPA's studies has been to date. One of these commenters questioned whether the high cost of EPA's efforts is worth the outcome.

  EPA's Response: Actual costs of the studies to date were compiled and sent to the commenters. This same information is available to any individual who requests it. With regard to the tailings and waste rock, EPA has selected those actions that effectively address the identified problems.

- Comment: The Colorado Department of Health (CDH) recommends that Operable Unit No. Two be redirected to evaluate all major sources of contamination from mining waste piles in the study area to determine the relative contribution of each source, to develop a quantitative estimate of the environmental improvements from remediation of any and all sources relative to the district-wide impact of mining waste, and to select the necessary remediation based on the significance of each source. CDH also recommends that the selection

of Applicable or Relevant and Appropriate Requirements (ARARs), with respect to technical feasibility and cost effectiveness, should also be reexamined as a part of this redirected effort.

EPA's Response: EPA has evaluated the district-wide impact of mining waste in relation to the proposed remediation. EPA recognizes the potential contamination from other sources and these sources will be studied in the future by the State of Colorado. EPA believes, however, that the current remedies are cost-effective and will reduce contamination to the surface water. Therefore, the current remediation should proceed as scheduled.

- Comment: With regard to ARARs, CDH made the following comments: selection of the preferred alternative will require waiving several ARARs, such as revegetation standards under the Colorado Mined Land Act and prohibition of waste disposal in ground water (Gregory Tailings), as they will not be met under the remediation. Discharge standards under Colorado 40 CFR 440 are relevant and appropriate based on past activity on the site. Resource Conservation and Recovery Act (RCRA) ARARs are not relevant because of the mineral waste exclusion and because testing showed them to be nonhazardous. The wording in paragraph 5, page 2-28 of the draft FS Report, where it is stated that Federal Water Quality Criteria (WQC) for certain parameters are relevant, should be changed to say that WQC are relevant, with only the specifically noted parameters identified as exceeding the criteria. As noted above, CDH believes that ARARs should be related to the overall remedy rather than just the five piles that now constitute the site.

EPA's Response: EPA will incorporate CDH's suggestions concerning the WQC parameters exceeding the criteria. EPA's preferred remedy for the five piles is an interim measure. EPA will continue to evaluate these ARARs as part of the overall remedy for the site.

For example, Colorado 40 CFR 440 will be considered in the designs of Operable Units One and Three.

2. Study Methods and Findings

- Comment: The City Administrator of Central City, responding on behalf of the City Council to EPA's request for public comment, expressed concern about the possible impacts of EPA's preferred cleanup alternative on the community's businesses. In reference to controlling runon to the parking area near the Quartz Hill site by building ditches to divert water around the parking lots, the City Administrator noted that even the presence of construction equipment could be detrimental to the businesses because of the confusion and noise that potential customers might find intimidating. The City Administrator believes that closure of the lots, even temporarily, could cause serious problems. Construction during the 90-day peak business season would be most detrimental to the businesses according to the City Administrator. He is also concerned about the effect of the ditches on entrances and exits. In addition, he is concerned about the loss of parking spaces in the lots if efforts to stabilize the slopes reduce the size of the lots. He noted that asphalt capping, if capping is part of the solution, could enhance the parking lots and would be beneficial to the community. The City Administrator asked that EPA provide the City with any plans or drawings that would affect the parking lots.

  EPA's Response: EPA will consider these issues during remedial design and will consult with the City during this process.

- Comment: The City Administrator of Central City also questioned whether the runon control system would have an effect on the City's drainage system. He asked where runon water would be diverted and whether the changes created by the runon solution could create

additional risks of flood hazard for the City. The City is seeking Community Development Block Grant funds to resolve concerns identified in its flood hazard report. He asked whether EPA's efforts to control runon and the City's efforts to control stormwater drainage could be mutually beneficial. He requested that the City be kept informed of EPA's intentions so that the City and EPA can coordinate future efforts.

EPA's Response: EPA will consider the effect of diverted runon water on the City's drainage system during remedial design. EPA will consult with the City during remedial design and will keep the City informed of plans that may affect the City's stormwater drainage system.

- Comment: A mining engineer commented that the FS finding that slopes at the site are unstable contradicts common sense and good engineering practice. He said that the fact that the slopes have stood in place for over eighty years, and probably have been subject to some measure of flooding during that time, are indicative of their stability. The Mayor of Idaho Springs also commented that the mine dumps are more stable than most soils because of a cementing action that takes place in the tailings piles, and requested that this cementing action be discussed in the FS Report. Another commenter indicated that, because of the length of time the tailings have been in place, he does not believe that there are any particular time pressures for removal of the tailings.

EPA's Response: The stability of the waste rock at the Big Five was evaluated using accepted geotechnical techniques. The "cementing" of the material was considered in the evaluation. After further review of the evaluations and site inspections, EPA believes the conclusions are correct. It should be noted that since Clear Creek was re-routed due to the construction of Interstate Highway 70, the

river channel has been narrowed and has undercut the toe of the waste rock pile. This undercutting has resulted in some failure of the Big Five pile and has caused the current unstable conditions.

- Comment: Regarding the conclusion in the FS Report that the mine tailings must be cleaned up to prevent them from washing downstream and contaminating the Golden water supply during a flood, a mining engineer said that under flood conditions, the creeks would be contaminated with or without mine tailings. The Golden water supply would be contaminated from many sources in addition to mine tailings, so the conclusion that potential flood conditions justify slope stabilization is not supportable. He commented that EPA should focus its attention on preparing the Golden water treatment plant for flood conditions rather than attempting to stabilize the tailings and waste rock piles in the area. The Mayor of Idaho Springs also commented that the RI report "...assumes a worst case scenario, the collapse of tailings from a 500-year flood collapsing into low stream flow conditions. It would take flood conditions to cause collapse. Flood conditions are not low stream flow conditions. I believe these conditions are mutually exclusive, and that 'worst case condition' is not possible."

  EPA's Response: The RI Report considered a realistic scenario. Simply, the volume of waste rock currently evaluated to be unstable was placed in the river under low flow conditions. Under flood conditions, the volume of unstable waste rock would have been much greater than that used in the evaluation.

  Currently, Golden can treat contaminated water. It cannot treat large volumes for long periods of time, however. It is EPA's position to prevent contamination rather than treat it after the fact.

- Comment: Several residents commented that they and others had grown up in the area and have never experienced adverse health effects from the tailings. Many residents expressed skepticism that health risks were of any significance. One commenter said that the FS Report and Proposed Plan presented data that did not show or explain risks or reach any conclusions or recommendations about risks. He said that statistical estimates of risk alone did not help him understand whether site contamination poses a genuine threat to human health.

  EPA's Response: Risk calculations, such as those presented in the Proposed Plan and in the FS Report, provide estimates of risk. These estimates are based on a consistent set of assumptions, so that these standards can be applied to all types of conditions and locations at a variety of Superfund sites across the country. Current EPA guidance states that the risk for carcinogenic materials at a site should not exceed 10^{-4}, and preferably should be less (e.g., 10^{-7}). These figures refer to a range of risks that a population may face when exposed to a specific hazard. For example, a 10^{-4} risk is the risk assessors' projection that a population exposed to a particular hazard may suffer one extra cancer death per 10,000 persons; a risk of 10^{-7} means there might be one excess cancer death per 10,000,000 among a population exposed to the hazard. The risks at the Clear Creek/Central City site are presented in Table 1 of the ROD and in Chapter 10 of the RI Report issued June 8, 1987. As can be seen in Table 1, current human health risks resulting from the inhalation and ingestion exposure pathways are minor. However, under an assumed future residential exposure scenario, risks are present for people who might live on the waste rock/tailings piles. Therefore, EPA has selected the no action alternative for current episodic use of the piles. For future residential use, EPA will work with State and local officials to pursue controls to limit future residential development.

For noncarcinogenic materials, EPA has established maximum acceptable exposures ("reference doses") that should not be exceeded to protect human health.

- Comment: A newspaper reporter commented that some of the wording in the FS Report and other documents was tentative or inexact. The commenter noted that as a result, EPA's remedial actions may not actually occur as stated or may be only hypothetical. She also questioned selection of passive treatment as a final alternative when it is still considered experimental. An owner of one of the mining properties at the site commented also that the use of the no action alternative in the study made no sense and was used only as a "scare tactic" to convince people of the necessity of EPA's actions.

  EPA's Response: When possible, EPA will change the words to be more specific. Selection of the passive treatment system was part of the remedy for Operable Unit One. Passive treatment effectiveness is currently being studied at a pilot plant at the Big Five. These data will be used to determine final design. Final design may include additional treatment to meet standards. Consideration of the no action alternative is required under Superfund and other environmental regulations to provide an estimate of the risk or damage that will result if no remedial action is taken.

- Comment: One resident asked that source control be defined.

  EPA's Response: Source control is the identification and elimination or blockage of mine drainage at its source to prevent further flow of contaminated water through the environment. In order to be more specific, EPA has changed the term to discharge control. Discharge control includes any method to control or eliminate the drainage from the tunnels.

- Comment: A commenter asked why fresh water runon has to be controlled if it does not carry acids when it runs over the tailings piles.

  EPA's Response: As it mixes with minerals in the tailings, fresh water will turn acidic and leach metals from the piles. The water will also carry suspended materials.

- Comment: A newspaper reporter asked why reprocessing of tailings was not the preferred alternative, since the Proposed Plan indicates that reprocessing of tailings is the only way to reduce the mobility, toxicity and volume of the tailings. Several other commenters said they thought the costs of reprocessing presented in the study were extremely high, relative to their own estimates. A commenter employed by a company that conducts feasibility analyses of reprocessing mine dump and mill tailings materials in the Clear Creek/Central City area said that EPA's estimate of $27 million for reprocessing the tailings at the five mine properties is overestimated by a factor of at least ten. He asked why EPA has the right to evaluate the proposals as if the Agency owned the property in question. Several residents asked why the mine property owners could not reprocess the tailings on their own as the primary means of cleaning them up.

  EPA's Response: Although reprocessing the tailings is the only alternative that meets the criterion of reduction of mobility, toxicity and volume of the tailings piles, this criterion is only one of nine criteria against which an alternative is evaluated. Other alternatives that EPA considered also were expected to reduce mobility and toxicity but not necessarily volume. Cost estimates to reprocess the tailings were prepared by metallurgical engineers considered to be experts in the area of reprocessing. To ensure the

tailings had a reduced toxicity after reprocessing, metal concentrations had to be reduced to low levels. This requirement precludes some types of reprocessing. EPA has authority under the Superfund law to take actions to protect public health and the environment.

- Comment: CDH expressed concern about conclusions regarding leaching problems with the waste and tailings piles and saturation of some of the piles. CDH said that sufficient data may not be available to justify these conclusions. CDH also questioned whether air monitoring data have been collected and how such data are related to risk analyses or action levels. CDH said that the conclusion that the inhalation pathway does not present a significant hazard may be based on an unsubstantiated risk analysis, if air quality monitoring has not been conducted. CDH recommends reconsidering the air quality action levels, and suggests specific action levels in addition to establishing background levels by air quality monitoring prior to remedial action. Lastly, the State requests EPA to verify that sampling of runoff from piles included maximum runoff events.

  EPA's Response: Site-specific air quality samples were not collected. Rather, site-specific data for soils and regional/local air data were used to model worst-case scenarios. Given that worst-case models revealed low concentrations, no further evaluations had been planned. However, the State may conduct limited air sampling as part of their upstream sources study.

  Runoff from the piles was collected during two storm events that occurred during the RI. These storms were not maximum storm events. The concentrations in the runoff were extremely high, however, and may represent maximum levels.

- Comment: CDH commented that the statement that the abundance and diversity of aquatic life in Clear Creek has been reduced due to acid mine drainage (FS Report, page 1-32) needs to be verified by a comparison of historic and current populations. If the statement cannot be verified with data, CDH suggested qualifying it.

  EPA's Response: The statement was based on data collected before the RI was initiated. No studies were performed as part of the RI. EPA will make that clear in the FS Report. Additional studies are planned to be completed.

- Comment: CDH commented that the discussion of tunnel discharge flow paths (FS Report, page 1-35) should be checked for accuracy. By example, CDH states that discharges from the Argo Tunnel and the National Tunnel travel some distance before flowing into the creek, and that movement through the discharge channel may affect the suspected contribution to ground water contamination.

  EPA's Response: Currently, it is believed that iron hydroxide precipitates create a "seal" in the discharge channels, thus minimizing infiltration. This is verified at the Argo Tunnel in that no seeps are observed on the bank below the discharge channel and no general ground water mound is observed. That is, no general ground water rise is observed around the discharge area.

- Comment: CDH commented that EPA must provide further justification for its use of the mine waste material underlying the tailings and waste rock piles to determine the baseline elemental analyses or "background," due to the possibility that this material is contaminated both by mine wastes above the material and by ground water below it.

EPA's Response: All available data were examined to determine background concentrations. Some material below the tailings contained elevated concentrations of metals. EPA determined that these samples were not representative of background conditions, and they were eliminated from the background samples. To verify that the background concentrations were reasonable, the values were compared to published data for western soils. In addition, EPA recently took additional samples both above and below the Big Five tailings on the south side of Clear Creek. Based on analysis of these samples and comparisons of all gathered data, EPA has concluded that the identified background concentrations are reasonable.

- Comment: With regard to slope stabilization (FS Report, page 2-41), CDH commented that: 1) a discussion of the proposed no action alternative at the Argo, National, and Quartz Hill Tunnels should be included; and 2) stabilization of the undercut portions of the Argo pile should be included in the preferred alternative because a slope failure could impact people inside the structures on the slope, not just the structures.

- EPA's Response: The no action alternative was discussed for each property in the ROD. The owner of the Argo pile has recently performed some slope stabilization. The Superfund program is authorized to address human health and environmental problems only as they are created by hazardous substances, pollutants, or contaminants. Safety concerns, such as those at the Argo waste rock pile, are more appropriately addressed by other programs, such as the Colorado Mined Land Reclamation Board, or by owners of the affected property.

- Comment: With regard to comments made at the November 24, 1987 meeting about the Gregory Tailings retaining wall, CDH recommends

that efforts at that property be directed toward a negotiated settlement with the landowner to reprocess the pile within a reasonable time frame, maintain the gabion wall until completion of the project, and construct a final slope that does not require a permanent retaining wall. If settlement is not possible, the State recommends that remediation plans utilize rather than remove the gabion wall as part of the final plan.

EPA's Response: Use of the current gabion wall as part of a more permanent wall has been evaluated and determined not to be cost effective. That is, the gabion wall cannot be made more permanent without major costs. EPA is recommending that the current gabion wall be maintained and monitored, and replaced only when necessary. EPA will continue discussions with the landowner about reprocessing.

- Comment: The State commented that active erosion at the Quartz Hill parking lot is not addressed in the FS Report, noting that this issue should be considered. Problems associated with this erosion include environmental and health concerns about the sediment, and the possible safety hazard posed by cars parked on the edges of the lot. The Department recommends regrading of the lots to provide more stable side slopes; construction of berms around the parking surface perimeter to control runon to the side slopes; routing of runoff to stabilized channels; and extension of the lot back to the Quartz Hill tailings to recover lost parking spaces. The State also recommends that EPA consider paving the parking surface and sealing the side-slopes because of the district-wide significance of this pile.

EPA's Response: EPA has studied the active erosion at the parking lots. As recommended by CDH, berms and ditches will be constructed for runon control. Runoff channels will also be stabilized. Detailed designs will be provided during the remedial design.

Detailed designs will be provided during the remedial design. Paving is currently not planned, because analysis showed there are no potential human health effects from inhalation of blowing dust at the parking lots. EPA acknowledges CDH's plans to evaluate impacts due to blowing dust from the parking lots.

- Comment: CDH commented that the use of soil cover (capping) as a remedial technique was discarded too early in the screening process. CDH believes that, in contrast to the statement in the FS Report on page 2-61, the soil cap may have sufficient storage capacity to reduce percolation of water into the waste significantly. In general, the state recommends reconsideration of soil cover and/or revegetation as a viable leachate and erosion control technology.

  EPA's Response: EPA has concluded that generation of leachate due to infiltration is not a problem, and therefore, a cover or soil cap is not needed for leachate control. Regarding erosion control, runoff due to direct precipitation on the surface is a relatively minor source of contamination versus runon to the tailings and waste rock piles. Therefore, even though a soil cap can be effective in preventing erosion, EPA has determined that it would be significantly less cost-effective than use of the preferred runon controls in preventing erosion.

- Comment: With regard to neutralization agents (FS Report, page 2-83), CDH commented that no discussion is given to the volume of neutralizing agent that would be needed. The State believes that it is possible that the volume of kiln dust needed would negatively impact the project to the extent that use of the next most inexpensive agent (commercial lime) may be warranted.

  EPA's Response: In evaluating the proposed alternatives, EPA considered fixation of only the upper 18 inches of waste material.

Given this limited depth of fixation, the volume increase (even though significant on a small scale) is not a concern. For example, even a volume increase of 50 percent would add only nine inches to the top of the pile.

- Comment: The State recommends that the diversion ditches that will be used to control runon at the site be lined with something less costly than concrete. The State believes that ditches should be constructed in undisturbed ground if possible to minimize contact with waste. The State also says that an operation and maintenance (O and M) component should be added to the cost estimate.

  EPA's Response: EPA has re-evaluated the lining material for the ditches and currently believes that soil cement may be a more cost-effective option. CDH's other recommendations will be evaluated in the remedial design phase. O and M costs have been added to the cost estimate and are provided in Table 3 of the ROD.

- Comment: CDH noted several typographical errors in the FS Report.

  EPA's Response: EPA appreciates the comment; these errors will be corrected.

3. Government and Superfund Procedures and Activities

- Comment: A mining engineer and representative of a local mining organization asked what weight community comments have in the selection of the final alternative and in EPA's decisions about the Clear Creek/Central City site.

  EPA's Response: Under the Superfund program, Congress requires EPA to consider community comments along with eight other criteria in making a final selection of remedies. At the Clear Creek/Central

City site, EPA has modified its original plans and is currently considering several additional changes, based on public comments. Superfund requirements dictate, however, that EPA clean up the site. These requirements do not permit the Agency to abandon a site that poses a threat to public health and the environment or to lower its cleanup standards.

The other eight criteria that EPA considers in choosing a remedy include compliance with ARARs; reduction of mobility, toxicity, or volume of contaminants; short-term effectiveness; long-term effectiveness; implementability; cost; State acceptance; and overall protection of human health and the environment. These criteria are discussed in the ROD.

- Comment: Several residents, including owners of two of the five mining properties, said that EPA's actions do not take property owners' rights into account, tie up their properties for long periods of time, have no regard for the hardships that the process creates for them, and involve them in legal and bureaucratic issues that put their lives as well as their properties on hold. One of the owners alleged that EPA staff have trespassed on his property without permission, have not properly informed his family of the Agency's plans for the property, and have not shown concern for them or for their rights. Another property owner said that EPA staff, particularly at the Gregory Tailings project, would not clean up the area after they were finished with their work and did not follow EPA rules for managing a hazardous waste site.

  EPA's Response: EPA obtained a signed access agreement from the property owner in question before going onto the property. EPA has provided public notification of its activities in the past and will provide all property owners with information and direct notification of all Agency activities in the future. EPA staff recognize the

burdens associated with being a part of the Superfund process and are committed to working as closely as possible with property owners in the future to resolve as many issues as possible within the constraints of the laws and regulations under which the Agency must operate.

- Comment: Several commenters had questions about the costs of the work that has been done for the Clear Creek/Central City site and asked if EPA is under pressure to spend a specific amount of money by a given date, regardless of needs or accomplishments. In a similar vein, commenters challenged the motivation of both EPA and its contractors suggesting that the work was being done only to maintain jobs and profits and not to accomplish necessary tasks.

  EPA's Response: Budgets are allocated to each site based on the needs and requirements of that site. EPA approves each work assignment to be performed by its contractors on an "as needed" basis. EPA staff are assigned to projects as needed and as staff are available. The Superfund legislation was intended to accomplish very specific goals. EPA and its contractors have met both the spirit and the letter of the law in carrying out the required work at this site.

- Comment: One property owner expressed concern about the limited amount of time available to him to comment on EPA's work on Operable Unit No. Two and to provide a proposal to EPA for cleanup of his property. The same property owner commented that EPA had requested his ideas and comments, yet the Agency did not provide sufficient information for him to prepare a cleanup proposal. Other commenters asked how EPA could evaluate proposals in two weeks, even if the property owners were able to submit proposals within the time-frame of the comment period.

EPA's Response: EPA extended the comment period for ten days, through December 18, to allow more time for community comment on the Proposed Plan. EPA also delayed making a decision on the Operable Unit until March 1988 to provide for a thorough review of all technical information and public comments. EPA staff agreed to accept any comments up until the remedy was selected. In addition, EPA staff agreed to review all plans and specifications for each property with the property owners, as requested. EPA has provided the property owner with all of the technical information that is currently available.

- Comment: Many citizens commented on the removal action that took place at the Gregory Tailings in the spring of 1987. Commenters raised several issues about the action, including the cost of the action relative to what was accomplished; the fact that a temporary solution rather than a permanent solution was carried out; the contradiction between EPA's original statement that the corrective action would last for twenty-five years and the current statement that the solution was designed only as a short-term remedy; the fact that solutions previously dismissed as inappropriate, such as construction of a retaining wall, are now being considered; and the concern of residents that work was being performed at the Gregory Tailings only because EPA wanted to take action of some kind and the Emergency Response division had the funding to do so. A son of the owner of the Gregory Tailings property said that reclaimable tailings are now mixed with dump dirt and more tailings are washing into the creek than before the removal action.

EPA's Response: EPA initiated the removal action at the Gregory Incline and Tailings to prevent a potential collapse of tailings into North Clear Creek. The Emergency Response Branch (ERB) of EPA is a separate branch of the Agency that is designated to respond to emergency and short-term needs to protect public health and the

environment. ERB typically develops and implements short-term temporary solutions under tight time constraints. Such actions may or may not have to be addressed permanently at a later date, under less critical conditions. EPA believes that the ERB responded with an appropriate solution.

- Comment: Several citizens expressed concern about EPA's past activities and motives, stating that EPA appeared determined to carry out the Gregory Tailings removal action regardless of its effects on human health and the environment.

  EPA's Response: EPA is committed to cleaning up Superfund sites that have been determined to be hazardous to human health or the environment. This is the Agency's only motive and the sole reason for its activities at the Clear Creek/Central City site.

4. Economic Issues

- Comment: One commenter expressed concern that EPA's proposed solutions will destroy the economic value in the tailings and create more problems than will be solved. In reference to plans for slope stabilization, another commenter said that a 2-to-1 slope (a 30° gradient) as described in the Proposed Plan would ruin the property associated with the Big Five tunnel because the slopes would be cut back so extensively that there would be no flat ground left on them where future mining or reprocessing activities could be conducted.

  EPA's Response: EPA selected options that would not interfere with future reprocessing (e.g., no covers or fixation). In the area of the Big Five, where the slopes are unstable, very little horizontal surface area exists. As a result, very little useful area would be affected. In addition, the stabilization would preserve waste

rock/tailings for future reprocessing that would be eventually lost due to collapse into the streams.

- Comment: Several commenters noted that investors would be reluctant to invest in the area as long as EPA's Superfund activities were ongoing. One commenter noted that even the State of Colorado is concerned about permitting mining properties because of the State's potential liability under Superfund. The commenters asked how long EPA planned to be at work in the area and when the work would be completed, so that those who may be interested in further development in the area could proceed.

  EPA's Response: EPA's primary concern at all Superfund sites is the protection of human health and the environment. Since the public meeting, EPA has re-evaluated and scaled back the extent of its planned activities in the area.

- Comment: A local newspaper reporter requested that EPA use local labor when doing site work in the area.

  EPA's Response: EPA is committed to using local labor when local contractors can meet the regulations and other contracting requirements that EPA is required by law to follow.

B. SUMMARY OF REMAINING COMMENTS

Several commenters asked questions that will be answered more thoroughly during later studies, when additional and more definitive information is available. These three remaining comments are summarized below, followed by EPA's preliminary response.

- Comment: Referring to EPA's Proposed Plan and FS Report, several commenters asked what overall effect EPA's efforts at the five mine

properties would have on contamination in the area, given the large volume of disturbed lands, tailings, waste rock, runoff, runon and erosion throughout the two counties. The commenters also asked if EPA intends to clean up all of the mined areas in the two counties and, if not, what difference will be made by cleaning up the tailings at only the five properties that together make up the Superfund site. In a related question, a mining engineer asked if drainage might have been naturally acidic before any mining or settlement took place in the area. If this is the case, he asked whether cleanup standards might exceed previously natural conditions. He also asked whether improvements to water quality from cleanup efforts at the five mine properties would be difficult to measure because of the extensive overall contamination in the region that continually enters the creeks from many other sources.

EPA's Response: EPA and the State are currently evaluating these issues to determine the overall effect of cleanup of the Clear Creek/Central City site given other possible sources of contaminants. Information regarding comparative volumes of mining waste and disturbed lands was included in the FS Report and the Proposed Plan to indicate that these issues are being considered. The cleanup efforts currently proposed and selected in Operable Units One and Two will result in a distinct and measurable improvement in water quality.

- Comment: One commenter expressed concern that a study of the total effects of Superfund cleanup on the area has not been done. As an example, this commenter questioned if a decrease of minerals in the creek might adversely affect crops grown downstream as allegedly occurred in the Arkansas River Valley when the Arkansas River was cleaned up several years ago.

EPA's Response: EPA's first responsibility under the Superfund program is to protect public health and welfare at designated Superfund sites. Established procedures have been followed throughout the RI/FS process at the Clear Creek/Central City site. As noted above, EPA is currently considering the issues of natural contamination and contamination from other sources, as well as the question about the overall effect of cleanup efforts. EPA's studies will not include a total environmental assessment for the entire Clear Creek drainage, however.

- Comment: The issue of blowout control was raised by several commenters. In particular, a mining engineer commented in a letter read at the November 24, 1987 public meeting on the possibility of blowout at the Argo Tunnel, the inadvisability of plugging the portal and the importance of reopening the tunnel. This commenter advised that the tunnels be cleaned out, the water be diverted, and the water channels be grouted to bring the mine back into production.

EPA's Response: EPA has initiated a study of blowout control. A draft FS Report on blowout control will be available for public review in July 1988. EPA will consider the commenter's recommendations during this study.

APPENDIX

CHRONOLOGY OF COMMUNITY RELATIONS ACTIVITIES AT THE CLEAR CREEK/CENTRAL CITY SITE

The list below summarizes community relations activities at the Clear Creek/Central City site. In addition to the activities listed below, EPA has met with area residents and local officials throughout the RI/FS.

- EPA prepares Community Relations Plan (CRP). (October 1982)
- EPA conducts on-site discussions with local officials and area residents. (September 1985)
- EPA establishes information files at three locations accessible to the local communities: the Gilpin County Court House, the Idaho Springs Public Library, and the EPA Library. (November 1985)
- EPA distributes a kick-off Fact Sheet about the site. (December 1985)
- EPA completes the draft Community Relations Plan. (January 1986)
- EPA releases a question-answer Fact Sheet on the proposed Expedited Response Action at the Gregory Tailings, holds a public comment period, and sponsors a public meeting on the ERA. (July 1986)
- EPA holds a public meeting on the proposed Emergency Removal Action at the Gregory Tailings, and signs a Memorandum of Understanding with the Colorado Historical Society. (March 1987)
- EPA releases a question-and-answer Fact Sheet on the well survey and writes an open letter to residents. (April 1987)
- In response to community requests, EPA expands the number of local-area information repositories to include the Golden Public Library and the Idaho Springs City Hall. (May 1987)
- EPA revises the draft CRP. (June 1987)
- EPA delivers historic preservation plans for the Big Five property to the Colorado State Historical Society. (June-July 1987)
- EPA distributes a question-and-answer Fact Sheet, conducts two public meetings, and holds a public comment period on the RI/FS and Proposed Plan for Operable Unit No. One. (June-July 1987)

- EPA places the complete Operable Unit No. One Administrative Record for the site in the information repositories at the Gilpin County Court House and the EPA Library, and an index to the Administrative Record at all five repositories. (August 1987)
- EPA distributes the Proposed Plan for Operable Unit No. Two and a public comment letter. (November 1987)
- EPA conducts a public meeting, and holds a public comment period on the draft FS Report and the Proposed Plan for Operable Unit No. Two, providing notification of the public comment period in local newspapers in legal notices and press releases. (November-December 1987)
- EPA extends the public comment period through December 18 and provides notification of the public through press releases in local newspapers. (December 1987)
- EPA announced through local media the delay in signing of the ROD on Operable Unit No. Two. The Agency remained open to public comment until the final selection of remedy for the operable unit was made on March 29, 1988.
- RI Addendum distributed to information repositories. (January 1988)